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EDITORIAL NOTES.

The Coronation that Did not Happen.

NOT as a subject for discussion, but only for the sake of recording the historical fact, would we briefly refer here to the sudden illness of the King, which caused the postponement of the Coronation, and rendered to an extent nugatory all the pains and expense that had been taken and borne, in regard to illuminations and other matters, for the due celebration of that event. When it was mentioned in these columns last week that the Coronation was overshadowing all the affairs of the day, it was the literal fact; but since then, in a moment, the Coronation itself has been overshadowed by that which is able to put out the sun in the sky for us mortals—the shadow of death. Even while our last issue was going out to the post, the blow fell; and the land which had awakened in the morning to the pleasurable excitement of seeing after more festivities, and putting a finishing touch to more decorations and illuminations, learnt that all was vanity, since the one chance that always lies in reserve to bring the plans of men to nought had been played. It did seem such a pity! No man with a tinge of the artistic temperament could think without vexation, added to the purely human grief for the stricken King, of the arrangements that had meant so much skill, and toil, and endeavour—all not permitted to serve their purpose! Well; "man proposes." This people has been called upon to bear much greater disappointments than the loss of a pageant, and has borne them stoutly. If more trials should be in store for us, we shall doubtless sustain them with a greater dignity than we have always manifested under the provocation of a happy occasion. *In manus tuas, Domine!* Our spoilt Coronation festivity was perilously near being a bore, and overdone. A touch of Fate transformed it into a tragedy; and it will make better history than anything we could have prepared.

In the preparation for the intended rejoicings, the gas industry had taken a conspicuous part, by helping to make provision for the brilliant illumination and decoration of the streets at nightfall. But in all save a few isolated cases, such provision has not yet been needed. We have the satisfaction, however, of now believing that it is only a pleasure deferred, and that a few days hence—perhaps even before these lines reach our readers—will see the streets of the Metropolis and all cities and towns flooded with the brilliance of thousands upon thousands of gas jets and electric lights as an expression of the fervour of the nation's thanksgiving for the safety of their Sovereign; and then, two or three months hence, when to-day's dominant hope has been consummated, they will again illumine the night. With other of our large industrial interests, the gas industry has no doubt suffered here and there (though we do not suppose in any remarkable degree) from the calamity of the past week—not from loss of gas consumption through the suppression of the illuminations, but through the closing, for the latter half of the working week, of many of the large manufactories and other business establishments in which unalterable arrangements had already been made for an entire cessation of work. Stock Exchange and Press predictions notwithstanding, it is generally agreed by gas managers that, even where there is profuse outdoor gas illumination, it will afford but slender compensation for reduced consumption in other directions. However, such loss and inconvenience as there have been for gas undertakings in the past week will have been cheerfully borne, and by this time will have been forgotten in the joy that the calamitous cloud by which the country was so swiftly overshadowed has been, by the mercy of Providence, so quickly lifted. All in the ranks of the gas industry will now look with pleasure for the days when they will be able to contribute their quota to the general thanksgiving and rejoicing.

Need of Capital to Over-Capitalized Concerns.

THE questions directly raised by the creation of the North Atlantic Shipping Combination have interest for the readers of the "JOURNAL" only in their capacity as citizens of the Empire, and are not for discussion in these columns. But there are one or two points connected with all large industrial undertakings that present themselves forcibly to the mind in considering the possible effect of the latest big amalgamation upon the commercial position of this country, which it may not be unprofitable to deal with. They are brought specially before our notice by an article contributed by "A Correspondent" to "The Times," entitled "Some "Dangers of the Industrial Combination Movement"—an article which, though very sketchy, is written with considerable knowledge. Of the writer's principal points, the first is that industrial amalgamations are almost invariably over-capitalized. Such over-capitalization means, first, of all, that the economies (if any) effected by combination are more than balanced by the cost of the dead capital—with the result that prices go up and business goes down; and, secondly, that the business is subsequently starved of the capital that is necessary to keep an industrial concern full of life and vigour. It is remarked:

> Over-capitalized companies never expend a sufficient amount upon renewals of plant, upon research work, or upon new developments of the industry. The necessities imposed by an inflated capital account prevent outlay in other directions; and shareholders, until they have received their expected 5 per cent. dividend, always clamour for full distribution of the surplus profits. This neglect to provide for developments and improvements in the manufacture has been the rock upon which many an industrial company has foundered in the past.

Instances of the truth of this statement it is not necessary to adduce, though in regard to undertakings such as gas and water companies, which have not to face the competition of other suppliers of the same commodity, equipped with plant of the latest type, and established upon a proper capital basis, such as most other over-capitalized undertakings have to face, the word "foundered" would require some little modification. The great danger that besets the managers of an over-capitalized concern which can raise the price of its commodity without immediately bringing about its destruction at the hands of competing suppliers, is the adoption of a policy of drifting and temporizing—of always postponing the evil day when re-organization must take place, even by resorting to expedients which, by further damaging the business, really hasten the crisis. Works cannot be starved indefinitely, depreciation must some day be made good, and the half-hearted work of an underpaid and dissatisfied staff and a neglected body of workmen (for a business short of money usually economizes upon those little matters of generosity that cost nothing in comparison with the good feeling they induce) soon tells its tale upon the cost-sheet; while the raising of the charge to the consumer brings Nemesis surely, and not always slowly. The first requisite for the cure of over-capitalization is courage of no low order, and then ability unhampered with tradition, and supported by money.

The other point raised by the correspondent of "The "Times" in regard to the dangers attending industrial combinations is that arising from centralized control. One-man management of a huge business may be a great success or a great failure. The risk of the second is not small; for there is no guarantee that a fitting successor will be found when the "great success" goes. It is easier to find good lieutenants than good field-marshals. Moreover, there attaches to the one-man system a danger which is often ignored. To quote again:

> In these days of rapid change and improvement, new methods of work and new mechanical devices are always being invented. A few of these are of value, and lead to economy of manufacture in the industries concerned; the majority are worthless. It is always a difficult task to discriminate between the two classes of invention, and mistakes are at times bound to occur. When the decision is vested in one technical director or chief, a mistaken appreciation or depreciation of a new process or invention affects the whole industry, and retards its progress and development in the particular country. Under the old system, such a general retardation was impossible; for the new process

or invention was bound to receive trial at the hands of some of those engaged in the industry, and, if successful, its gradual adoption by other firms was certain. That this danger is not an imaginary one is proved by the history of the past ten years in the English alkali industry.

The gas industry not being combined like the alkali, the danger described is not by any means so serious to it; but it is one to be borne in mind by the managers of the larger undertakings. The engineers of the several works of a large concern should be allowed a free hand in the way of experimenting with new plant and processes. But that cannot be done if capital be stinted. The gas business to-day more than ever requires brains backed by money to enable it to go on and to prevent it from slipping back.

The English and Other Patent Systems.

THERE is a class of speakers and writers on industrial subjects who profess to hold the belief that the system followed by a nation in respect to granting patents for inventions powerfully affects the industrial character and development of the country. This is not the view taken of national patent systems in these columns. With all due respect for whatever good influence may be exerted by the patent offices of the world, as to which there is more than one cast of opinion, we distinctly incline to the view that to make the patent the originating cause of the invention, is to put the cart before the horse. We have also on sundry occasions taken the opportunity for testifying to the superior all-round excellence of the British system, and particularly to the admirable way in which it is carried out by the department entrusted with this duty. This preference for the national system was never confined to these humble columns, because there was always a crowd of witnesses ready to testify to the same purpose. The truth of this matter was, and is, that there is a very "go as you please" character about an English patent which is not to be found in any other of the really considerable patent systems of the world. This liberty harmonizes with the national spirit, which understands freedom rather better than most. It is this principle, operative if unavowed and often misunderstood, by which the English Patent Office gives an applicant what he asks for, and leaves the rest to himself. It is no part of their duty to tell the applicant more about his invention than he knows himself, or to trim it up for him until it is what is officially regarded as improved and safeguarded.

Recent disclosures have gravely disparaged in the eyes of the world the reputations of the two foreign patent systems which certainly undertake that task of "official examination" so loudly asked for by some would-be reformers of the English system, and as certainly do not guarantee the validity of the protection ultimately granted, notwithstanding the delusion fostered by the same amateurs that this is the outcome of the official labours. When it takes fourteen or fifteen years to get an application of inventors holding the rank of Edison, Thomson-Houston, and Maxim through the United States Office, there is no irony in asking whether such a patent system is not altogether too careful for this world. In the case of Germany, where the power of the Office to refuse a patent is the logical sequence of the official examination, a great victory over bureaucratic blundering and arrogance has recently been won by English applicants, which is such a wonderful circumstance that it deserves the widest publicity. After failing in all the lower Courts, and in the Office itself, the applicants appealed to the Supreme Court of the German Empire, and succeeded in getting the decision of the Patent Office reversed in their favour. Those who fail to see in such records any evidence that patent systems really encourage invention and industrial progress will be fortified by the great illustration of the life-work of the late John Glover, the inventor of the "Glover tower," which for a generation made all the oil of vitriol in the world. It was not patented.

Misunderstandings.

IT is extremely difficult to secure sufficient recognition of the obvious in the work-a-day world. Clever folks are apt to flatter themselves that cleverness is the one thing needful in the business life; but it is impossible to go far along the common road without being fully convinced that something very far short of what could be called, even by courtesy, cleverness, is conspicuously lacking in many quarters where it might be looked for. The complex relations subsisting between gas companies, ironmongers and gas-fitters, and the public, furnish in bewildering variety a host of illustrations of the truth of this observation. So many, indeed, are they, that it is difficult to select one to begin with. Let us take, however, the situation created by the high-handed interference of Sir George Livesey with the policy of the old Welsbach directorate. His guarantee fund was the Sword of Brennus that, thrown into the balance, made the empty scale on the other side kick the beam. Why did he do it? Ask the ironmongers; and they will profess to be unable to fathom Sir George's motive, if it was not that of a deadly hatred of their whole tribe. It is in vain that he protests that he really does not hold the ironmongers in high despite—that, for all he cares, they may live and prosper, so long as they do not make a mess of the trade in incandescent burners. The worthy tradesmen in question cannot understand it at all. The gas companies, in many places, took away their custom in gas-stoves; and now they want to go in for this mad scheme of incandescent burner maintenance, regardless of the outraged feeling of the ironmonger! If the ironmonger is a Londoner, he may weep into his black apron without altering the trend of events. If he is a provincial shopkeeper, he can always hope to get into the town council, and from his place there make himself disagreeable to the gas company or the gas committee. The plain answer to all this is that the ironmonger once had his chance, and he threw it away. Instead of helping to popularize the incandescent mantle by offering to take care of it, he in many instances preferred to snatch a little higher retailer's profit by dealing with infringers; and now the "trade" is very much out in the cold.

Yet how arduous is the task of convincing some worthy burgesses that, in offering to supply and maintain the incandescent system at a close shave of the cost price, the gas company have not some deeply-laid plan to further! It looks as though, both on and off certain boards of directors we wot of, there were incapacity to apply to a gas business the ordinary rules of competitive trading. The use of gas is apparently supposed to lie outside the common principles of successful commerce. The recent clever skit in a London evening newspaper, about the proceedings of an imaginary "society for preventing the use of gas" went very near the facts of one's every-day experience. It is creditable that a specimen of the genus "director," species "gas," might even now be stalked from near the Houses of Parliament, who, on being offered his life in exchange for the truth of his soul, would state that in his belief the price of gas has nothing whatever to do with the demand for it. We were also told the other day of a set of managers of a public institution who hesitated for weeks over the offer of the local gas engineer to improve their lighting at no extra expense for gas consumed, simply because it passed their comprehension what the company could be thinking to gain by the transaction. They politely declined to believe that the only motive of the company was to give them satisfaction. The difference between a stupid gas director and an obtuse gas consumer of this category is not one of kind, nor even of degree; it is chiefly one of position. And such are the notabilities of the world! What said Carlyle on the subject?

The Defects of English Education.

THERE would not appear to be much for us to comment upon in the report of the Committee on the Education and Training of Officers of the Army, which created such a painful impression on the public mind when it was published the other day; nor, in the ordinary way, is there. But we have recently had occasion to animadvert upon the defects of that division of the national education system which is supposed to prepare the rising generation for a career in the higher ranks of the industrial army; and it is a coincidence at least worthy of being remarked, that the Committee on Military Education find exactly the same weakness in the preparation of aspirants for the particular kind of technic which they had in view. Having regard to the social rank of those from whose families candidates for Army commissions are mostly drawn, and knowing that these lads, as a matter of course, go to expensive schools, it is simply shocking to learn that, as a class, they are "deficient in general education." Whither, then, shall a

professional man send his sons with confidence that no such judgment could be passed upon them when, in the fulness of time, they proceeded to specialize for their life's work? We hear sometimes of the desirability of protecting the entrance to this or that profession with safeguards against presumptuous ignorance in the form of a qualifying examination. Alas! It is the bitter experience of the Army that success in a competitive examination for entrance into Woolwich or Sandhurst is no guarantee against the after appearance of these educational defects. It is the old story indeed—the multiplication of "subjects" to the sacrifice of the training of the mind, while putting a premium on "the "mere temporary acquisition of unassimilated knowledge." The examination system has been given too firm a hold upon the educational institutions of the country, of every order, to be disestablished; but the Committee on Army Education urge that candidates should be directed to the choice of subjects likely to be useful to them in their career, and also of a character to develop their power of acquiring knowledge, and using it when acquired. The advice is of general validity.

The Taxation of Gas Franchises in America.

At a time when there is a good deal of talk about systems of taxation and methods of raising revenue, it is interesting to observe how these things are done abroad. The current year's income-tax will take a considerable slice out of all gas dividends; but it may be consolatory to the recipients of the diminished warrants to learn that, even in the United States, unmixed satisfaction does not prevail as to the manner in which the Government helps itself to a share of gas profits. It appears that the State of New York in 1899 made a foray upon the "unearned increment" of the trading corporations within its borders, under the style of the "Ford Law," for classifying franchises as real estate for purposes of taxation. The result of the passing of this Act of the State Legislature has been most momentous. A State Board of Commissioners was appointed to value properties for the tax; and they went to work against the "corporations" with hearty good will. For 1901, the Commissioners valued the gas franchises of the Consolidated Gas Company proper at $13,990,000. The valuation of the New Amsterdam Company's franchise was put at $4,127,500; of the Standard Company, at $3,075,520; and of the Mutual, at $2,300,000. Altogether, the gas franchises stand valued at $23,493,020. The original Edison electric lighting franchise is valued at $6,202,750; and the other franchises of the Electric Power Company at $1,883,330—or, together, $8,085,580. For all the active gas and electric supply franchises of New York, therefore, the assessment is $31,578,600, not including the two subway franchises, valued together at $6,395,200. The grand total of the franchises controlled by the Metropolitan Consolidated interest is, on this assessment, $105,000,000, on which a tax of 2¾ per cent. is levied. As the market value of the stock and loans is four times this figure, it is comfortably reflected by the municipal reformers of the City—at other people's expense, which is the badge of Progressivism the world over—that there is still a large part of the "unearned "increment" still to be reached by taxation, or otherwise "recovered for the people." The idea that the people have a right to "recover" what never belonged to them is impressive. It appears that the law of the United States recognizes the right of eminent domain, under which it is assumed that the Municipality, as representing the Sovereign State, would be able to expropriate any private property owner in the public interest, paying him a just, but not inflated, compensation. We have the same general principle of law here; and it is by virtue of it that powers of compulsory land purchase can be obtained—but only by statutory process. No British Municipality cou'd claim to represent the sovereign power in this respect.

Suggested Junior Gas Association for the Metropolis.

We wish to direct the attention of the juniors of the London and suburban gas undertakings to Mr. J. M. Campbell's letter in our "Correspondence" columns, which is intended as a "feeler" to ascertain whether or not a society on similar lines to that which is so successful in the Manchester district would be supported in London. It is rather a reproach to the juniors of London and the suburbs that a Society should exist in the Manchester district with a record of which those who instituted it may be proud, while one, with equally and perhaps more promising ground open to it, has not been successfully established in London. There was in London a few years since a Society of young gas men who met in an out-of-the-way place in the City Road; but, if those who had the management of the Society will forgive us saying so, they were altogether too modest to make it the educational success which they hoped for. We trust that Mr. Campbell's letter will mark the beginning of a Society that will be worthy of the large district it can command; and anything the "Journal" can do to forward the suggestion and subsequently the work, if the Society is established, shall be done. At the same time, we are hoping that the Institute or the Institution, or better still their unified embodiment, will soon take the matter up, in the way already advanced in these columns. Meanwhile, organization among the juniors of the gas profession will help to that end by showing to their seniors a sincere desire for opportunities for broadening experiences.

Modern Competitors of Coal Gas.

M. A. Lecomte, of Paris, is one of those gifted and active investigators whose researches are always productive of something enlightening and instructive, and the communication of the results are ever received with pleasure and accepted with respect. The special field to which his taste has led him is that of lighting, and the methods of producing light; and on this subject he possesses the power of lucidly reporting the details of the most abstruse points in the admirable manner of Professor Vivian B. Lewes. Of late years M. Lecomte has been turning his attention to the study of that lesser class of illuminant competitors of coal gas which comprise carburetted air, petroleum, and alcohol. He presented an able paper on the subject at the International Congress in Paris in 1900; and now he has given to the Société Technique du Gaz (as will be seen by our "Technical Record") a communication which brings the technical details in regard to these competitors up to date. It will be remarked that of these various competitors with coal gas, alcohol has made the most distinct strides since 1900; and M. Lecomte has arrived at the general conclusion that alcohol and other lamps have by no means reached their limit of efficiency. But nevertheless (in his view), these competitors with coal gas are more serious rivals than oil, electricity, or acetylene; and he cautions gas managers that it will only be possible to successfully oppose them by making oneself thoroughly familiar with their strong and weak points. This was the burden of a recent article in the "Journal" on "Oil in the Incandescent Lighting Field."

A Prodigal Lord Provost.

From Aberdeen recently (as noted by our Scotch correspondent last week), we had a striking example of how infatuation will make a man an inflexible enemy of economy. Union Street in that city has for some time been lighted experimentally by Kitson incandescent oil-lamps; and the Press and the public have taken a strong liking to the light. The second period of trial has lately expired; and, in view of the excellence of the results obtained, the Convener of the Watching and Lighting Committee, at a meeting of that body a few days since, proposed that the lamps should be purchased from the Kitson Company—giving, as his reason, that the light had proved itself the best yet brought out. Then Lord Provost Fleming, after the manner of men suffering from obstinacy and rigidly preconceived opinions, which even facts plain and proved will not upset, likened this return to oil in incandescent lamps as a retrograde step, and said that, even though the Kitson light cost only ¼d. an hour as against 2d. per hour for the electric light, he would not favour the adoption of the former. He moved an amendment against the proposed purchase, which, probably owing to his position, was carried by six votes to four. The disparity of price, of course, is not so great as the Lord Provost puts it. But, according to Professor Lewes, it is the difference between 1d. and 3¾d. per 1000 candles per hour; and surely this should be enough to recommend the former to all public economists. Going back to oil lighting in a certain form is admittedly a "retrograde step;" but to turn to

an oil system which produces an equivalent light to that obtained by electricity at a cost 275 per cent. cheaper, appeals to common-sense as a good progressive move in economical government. It is a constant complaint of the City Treasurer, so the local Press tells us, that the Common Fund has been depleted, and that the Town Council are short of money; and yet the Lord Provost—supposed chief guardian of the city's best interests—would commit the ratepayers to a piece of extravagance which cannot be justified. If oil is so very repulsive to the fastidious Lord Provost, has it not occurred to him that something cheaper than the electric light can also be had in the shape of high-pressure or self-intensifying gas-burners? The citizens must see to it that the action of a single man does not plunge the whole community into a lamentable waste.

Electric Lighting and Illuminations.

If the idiosyncrasies of the London County Council did not at times cost the ratepayers so much money, the proceedings of that body would afford a perpetual round of amusement. Occasionally, however, a little incident showing one of the many peculiarities of the Council crops up over which one can smile freely. We have a specimen this week. For months past, electric light fitters have been busy preparing for the Coronation illuminations; and (mark this!) three whole days before these electric light decorations would, had not misfortune overtaken the country, have been doing duty, the Council issued a warning note that in them lurked danger. Far be it from us to complain of the warning, but there is something rather amusing in the issuing of it almost on the eve of the illuminations, when it was (under the original arrangements) too late to be of any substantial use. The letter was sent to the London Electric Lighting Companies, to the Metropolitan Borough Councils supplying electric current, and to the Press, who received it in time to publish it last Tuesday morning. It stated that the Chief Officer of the Fire Brigade saw in the electric light illuminations a considerable risk of fire, on account of the temporary character of many of the installations, and owing to the fact that current in excess of that ordinarily supplied was likely to be used with temporary circuits added to existing installations. The suggestions were made that care should be taken to see that the insulation tests were sufficient, and that a certificate to that effect should be given by a competent surveyor. As it happens, the belated caution and suggestions may be of some service now; but that is a fortuitous circumstance which cannot be placed to the credit of the Council. Their solicitude for the people over whom they are supposed to exercise a watchful care should move a little more nimbly if it is to have any effectual result.

England's First Locomotive.

A most interesting relic of bygone days is at present being exhibited at the London offices of Messrs. Tangyes Limited, in the shape of the first locomotive ever made and run in England. This was invented and constructed at Redruth by William Murdoch, who is better known to our readers as an inventor in another branch of engineering. The date of construction of the model does not appear to be definitely known; but it was not until 1784 that it was ready for trial. Correspondence dated two years later, however, states that Murdoch had made his steam-carriage run a mile or two round a room, carrrying with it the fire shovel, poker, and tongs. At this time Murdoch was in the employment of Messrs. Boulton and Watt; and when Mr. Watt heard of the experiments, he advised their discontinuance, thinking they might interfere with the inventor's regular duties. He afterwards said that, if Murdoch was disposed to continue them, the firm would advance a sum of money and establish a locomotive engine business with him as a partner, on condition that within a year Murdoch succeeded in making an engine that would draw a postchaise containing three persons, with fuel for four hours and water for two hours, at the rate of four miles an hour. Nothing, however, came of this offer; and unfortunately both Murdoch and Watt ceased further to actively interest themselves in the subject of road locomotion, it being left to others to work out the problem. The model consists of an oblong board mounted upon three wheels, the water in the boiler being heated by a spirit-lamp; and the details afford ample testimony to the great ingenuity of the maker. Until 1883, it was in the possession of the Murdoch family; but it was then purchased from them by Sir Richard and Mr. George Tangye. By all who are able, advantage will doubtless be taken of the opportunity to see this little locomotive. It cannot fail to be of considerable interest to all engineers, but especially to gas engineers, who owe so great a debt of gratitude to the inventor.

A Coronation Advertisement.

Advantage was to have been taken of the Coronation festivities, by those in charge of the natural gas wells at Heathfield, in Sussex, to secure a good advertisement of the existence of this useful commodity in England. The proposal (certainly a novel one) was to send up a large number of balloons—filled with 5 cubic feet of natural gas—to each of which was to be attached a medal, having on one side the heads of the King and Queen, and on the other the following inscription: "Natural gas carried me from Heathfield, Sussex. Coronation Day, 1902." The intention was to dispatch these balloons at various times, according to the different direction of the wind; and as they were to be specially constructed to enable them to travel for many days, it was thought that the announcement of the discovery of the gas would in this way be carried to many parts of the kingdom—and perhaps also to the Continent—when the balloons burst. It has not been stated whether, under the sadly altered circumstances, the intention to send up these balloons was adhered to; but if it was, the medals (of whatever material they were made) will form interesting mementos to those who may have been lucky enough to find them, of an occasion which, though full of promise, has been fraught with such bitter disappointment to the whole country.

WATER AFFAIRS.

The London Water Bill in the Balance.

The debate in the House of Commons on the Education Bill, on the 23rd ult., necessitated the postponement of the consideration of the London Water Bill as amended by the Joint Committee; and accordingly this stage was deferred till to-morrow. Whether or not it will pass safely through the ordeal will depend entirely on the support the Government receive. Lord Salisbury stated this in very plain language to the deputation who waited upon him a short time ago to urge the importance of carrying the measure this session. If they are really desirous that this result should be achieved, it will devolve upon them to do their utmost to second the efforts of those who are working in this direction. June has faded into July, and the chilly, wet weather which a few weeks ago was the only thing looked to as likely to mar the brilliancy of the Coronation festivities, has now given place to hot days and bright sunshine. There is consequently some excuse for our jaded legislators encouraging the mood which the Prime Minister pointed out would be distinctly detrimental to the passing of the Bill. Any indulgence of the feeling that, having been pending so long, this question may well be allowed to stand over till next year, might result in frustrating the efforts of the Government to effect its settlement now, when public opinion seems ripe for it. The people have for years been led to believe that they would be much better served if the water supply were placed in the hands of a public body; and the Government have endeavoured to bring about this condition of things. They consider they have devised a scheme which, on the whole, is a workable one. It is embodied in the Bill before the House; and if it is not accepted, the Government will, at all events, have to be credited with the fulfilment of the promise repeatedly made, and reiterated in the Speech from the Throne at the opening of the session, that the London Water Question would be dealt with by an Imperial measure.

When preparing this measure, the Department entrusted with the work—the Local Government Board—had, it must be acknowledged, a very difficult task before them; and the outcome was a Bill which was received with all-round condemnation. But it has since been modified in several

important particulars, which have rendered it more satisfactory to the Water Companies, though it is still regarded by the London County Council—or rather by the Parliamentary Committee of that body—as inherently bad for the ratepayers and the water consumers of the Metropolis. Their views are fully set forth in the report which appears elsewhere, and which was presented to the Council at their meeting last Tuesday. First and foremost, the Committee object to the size of the proposed Water Board, which they consider should have been formed on the lines laid down by Lord James of Hereford in his Bill of 1896, or by Lord Llandaff in the report of his Commission; and probably it would have been, but for the somewhat remarkable procedure of the Committee. This, however, was settled by precedent, and is not matter for discussion here. The Board stands composed of 71 members, exclusive of the Chairman and Vice-Chairman; and when the Bill comes before the House, Mr. Sydney Buxton will endeavour to reduce it to the number which more nearly accords with the Council's views. The Committee offer some scathing criticism of the method by which the "deplorable result," as they regard it, of retaining the original schedule was arrived at; and they strongly condemn the decision come to, at the instigation of the City of Westminster, to insert in the Bill provisions which will, in their opinion, militate against any equalization of the water-rates. Again, they contend that the arrangement that has been made in regard to the deficiency rate, whereby it is apportioned upon one basis and levied upon another, will injuriously affect the interests of London ratepayers. In short, the Committee are intensely dissatisfied with the Bill and the entire procedure in connection with it. We acknowledge that in some respects this feeling is justified. For instance, the reference to a Joint Committee of both Houses, necessitated by considerations of time, was an effectual bar to the double examination to which schemes of the magnitude of this one are subjected in passing through Parliament. Again, the vacillation of the Committee over the question of the constitution of the Board—first calling upon the promoters to alter it materially, and then accepting, and even extending, the original scheme—is not altogether undeserving of some of the remarks made in regard to it.

While the Committee are only discharging their duty in putting upon record, in the form of a report, their views on the subject under consideration, we do not suppose the Council will be able to interfere with the progress of the Bill, or to obtain the amendment of those portions of it with which so much dissatisfaction has been expressed. After the critical examination to which it was subjected by the Joint Committee, it is scarcely likely that the House of Commons will be inclined, at this period of the session, to occupy itself with fundamental questions. Matters of detail, of which a goodly number stand upon the paper, will no doubt have all the attention they deserve. For example, Mr. Whitmore will propose that the first Chairman and Vice-Chairman of the Water Board shall be appointed by the Local Government Board, "until the time fixed by the "Act for the first new appointment of a Chairman and Vice-"Chairman." Again, Mr. Buxton wishes to amplify the clause of the Bill which specifies that the Board are to "exercise all the rights, powers, authorities, and privileges" of the company whose undertaking is acquired, by including the right of "raising, reducing, or altering the water-rate." The honourable member is also anxious that the clause relating to the Arbitrators shall contain an explicit direction to the Court that they are to ascertain "the fair and reason-"able value" of each of the undertakings, and, in so doing, to "inquire into and consider all the circumstances of the "case." It seems to us that the duties of the Court are sufficiently clearly indicated by the terms of the Bill as it stands; and the status of its constituent members furnishes ample guarantee that justice will be done to all parties concerned. It may be remembered that, in accordance with a promise made by him, Sir F. Dixon-Hartland endeavoured, during the proceedings in Committee, to obtain the insertion in the Bill of a clause to ensure that reservoirs shall in future be rated at their full annual value. Having been unsuccessful, he will renew the attempt when the Bill comes before the House. Finally, Mr. Long will propose a number of verbal amendments, and bring up a new clause making provision for the payment of the stamp duty on the transfer of an undertaking. These are some of the points on which amendments will be proposed; and with this brief indication of them we will leave the Bill to proceed on its way.

British Association of Water-Works Engineers.

THE Council of the British Association of Water-Works Engineers have arranged a programme of promising excellence for the annual meeting, to be held from the 22nd to the 25th of this month, at Leicester, which is a centre of perpetual interest for all gas, water, and municipal engineers. Many of the water engineers who will visit the town will find works for water supply which antecede them in existence, and others which illustrate the great progress made in constructive and mechanical water engineering during the last few decades right up to modern practice. The President for the year is the Corporation Water Engineer, Mr. Frederick Griffith, M.Inst.C.E.; and the mere fact that the meeting is being held under his presidency is sufficient ground to predict for it an absolute success, so far as human endeavour can make it. The Association are to receive the countenance of the civic authorities—first, by the welcome of the Mayor (Alderman Edward Wood, J.P.), and, secondly, by the privilege accorded them of using the Council Chamber for the meetings. The members on this occasion meet under the shadow of the loss by death of their President for the past year (Mr. W. A. Richardson); and they will be called upon to do collectively what many of them have already done individually, express their sympathy with the widow and family. The papers offered for consideration give the hope of good and profitable discussion; but the subjects dealt with are not so varied as the papers number. There are seven discussable contributions; but three of them deal with pumping plant, and a fourth with the application of suspended steam-pumps to the sinking of deep shafts. Of the pumping machinery group (which will be discussed together) two deal with turbine plant; the authors being Mr. C. G. Mason and Mr. C. Sainty, and the third is on water-power pumping plant by Mr. A. T. Walker. The one on suspended steam-pumps comes from the pen of Mr. W. Price Abell, M.Inst.C.E. The variation will be provided by Messrs. H. G. Keywood and J. Dewhirst with a paper on "Rural Water Supplies;" by Mr. R. S. Lloyd, M.Inst.C.E., with his contribution on "The Standardization of Water-"Fittings;" and by Mr. W. H. Humphreys, with his views on the subject of "The Electrolysis of Cast-Iron Water-"Mains." The discussion on this question by water engineers will afford as much interest to our gas engineering readers as to the water section of the professional fraternity. A lecture will also be delivered by Dr. Joseph Priestley on "Domestic Filtration." Papers descriptive of various local water-works, and one by Mr. J. B. Everard, M.Inst.C.E., F.G.S., on "The Utilization of the Upper Waters of the "Derbyshire Derwent," will be circulated at the meeting, but not discussed. As usual, visits to the local and neighbouring water-works form an attractive feature of the programme. On Wednesday and Thursday afternoons, visits are to be paid to the water-works of the Leicester and Loughborough Corporations, and the Friday morning and afternoon are to be devoted entirely to the Northampton Water-Works. The arrangements, times, and all details are set forth in the programme with admirable exactitude by the Secretary, Mr. Percy Griffith.

Coronation Honours.—The list of Coronation Honours published last Thursday contains, in addition to the knighthood for Mr. George Livesey, noticed in our "Personal" column, the following honours for gentlemen whose names appear more or less frequently in the pages of the "JOURNAL:" Privy Councillors: Lord Kelvin, G.C.V.O., F.R.S., and Sir John Dorington, Bart., M.P. Knights: Ralph Littler, Esq., C.B., K.C., J. M'Dougall, Esq., and Arthur Rücker, Esq., F.R.S. Knight Commanders of the Bath (Civil Division): Alfred De Bock Porter, C.B., and Professor William Ramsay, F.R.S. Of the two new Privy Councillors, it is only necessary to mention that Sir John Dorington was a member of Lord Llandaff's Commission on the Metropolitan Water Supply, as was also Mr. De Bock Porter, one of the new K.C.B.'s. As to the new knights Mr. Littler needs no introduction to our readers; Professor Rücker, the Principal of the University of London, was for a time one of the Metropolitan Gas Referees; and Mr. M'Dougall is Chairman of the London County Council. His Majesty has been pleased to institute an Order of Merit, and to make several appointments thereto in connection with the Coronation. They include the names of Lord Kelvin and Lord Rayleigh, F.R.S. The last-named gentleman was appointed Chief Gas Examiner for the Metropolis on the resignation of Professor Williamson.

ESSAYS AND REVIEWS.

THE GERMAN GAS AND WATER ASSOCIATION AT DUSSELDORF.

Special Report of the Proceedings.

THE Forty-Second Annual Meeting of the German Association of Gas and Water Engineers was formally opened at Düsseldorf on Wednesday last, by the President, Herr E. Beer, the Manager of the Berlin Municipal Water-Works. On the preceding evening, an assembly had been held in the Municipal Music Salon, where the Corporation of Düsseldorf entertained all those present to an excellent repast. Herr Marx, the Mayor, presided. Speeches of welcome were made by Herr Grohmann, the Manager of the local gas-works, on behalf of the Local Committee, by Dr. Thelemann, for the town of Düsseldorf, and by the President of the Association.

OFFICIAL WELCOME.

After the formal inauguration of proceedings on Wednesday morning by the President,

Privy-Councillor Theobald welcomed the Association in the name of the Prussian Government. He said that all who had visited the Industrial Exhibition at Düsseldorf marvelled at the brilliant technical achievements there displayed. More particularly did they marvel at the achievements of the gas and water engineers, to whose intelligence must be ascribed the fact that gas was still instinct with vitality, and had not yet been outstripped by electricity. He then enlarged upon the advances in science as applied to these industries. Herr Marx, the Mayor, expressed the profound pleasure of the town at the acceptance by the Association of the invitation of the authorities to hold the meeting there. He said that no other body was so closely associated with the problems and aims of municipal administration. A great number of the members were indeed actively engaged in municipal affairs. The Association had performed signal services in connection with the development of towns. At the Exhibition, one could not but marvel at the achievements of these branches of industry, in which the inventions, problems, and machinery presented were of such magnitude. The gas-engines at the exhibition proved that the members had placed all their abilities at the service of their calling. The speaker then referred to the gas and water works of the Düsseldorf Corporation, which had become so flourishing under the managership of Herr Grohmann. In conclusion, he wished the members pleasant memories of Düsseldorf, and that their desire might always be to live on the Rhine ("Am Rhein, da möcht ich leben!"). Mayor Haumann then extended a welcome to the members on behalf of the authorities of the Industrial Exhibition. It could not, he said, be too fully recognized that the gas installation at the exhibition had proved so successful. As a financier, he could particularly appreciate the economy with which it had been carried out. The authorities hoped that the technical men would visit the exhibition many times, as they could, as experts, undertake to pronounce a trustworthy opinion of the objects shown. He finally praised the scientific engineering of Germany, to which the great work of the exhibition was to be ascribed. Herr Möhler, Counsellor of Commerce, said, on behalf of the Chamber of Commerce, that they, as representatives of commerce and trade, took the greatest interest in the proceedings of the Association. Water supply and drainage were a great branch of industry. He rejoiced at these gatherings, which always gave fresh impulses to the advance of industries. The President expressed the thanks of the Association to the previous speakers. He said that industry brought about prosperity, as the example of Düsseldorf, which must now be universally recognized as a great city, proved. Though the exhibition in point of size perhaps was inferior to some which had preceded it, it was superior to them in other respects. Paris had shown what could be accomplished; but at Düsseldorf technical industry was more particularly and strikingly represented. He trusted that all the hopes engendered thereby would be fulfilled, and that it would be but the starting point for other brilliant successes. Herr Grohmann, the Manager of the Corporation Gas, Water, and Electricity Works at Düsseldorf, referred to these undertakings, and said he looked forward to the members visiting the works, and making themselves acquainted with them in detail.

THE READING OF PAPERS.

Then Herr Grassmann, a Mining Engineer of Essen-on-the-Ruhr, read the first paper, which was "An Account of the Coal Basin of the Ruhr District, with Special Reference to the Occurence of Gas Coal." He said that the coal won in the district of the Rhine and Westphalia amounted to 70,550,000 metric tons, or 65 per cent. of the total production of the German Empire. Of that, 54 per cent. alone belonged to the field on the right of the Rhine. He explained in detail the geological conditions. The carbonaceous deposits extended over 794 square miles, of which 195 square miles were the true pit coal measures. The Ruhr coalfield stretched as far as the neighbourhood of Münster, in the north of Westphalia; but it was a question what was its depth there. Coal mining had advanced with great strides in the district during the last eight years. Where the coal deposits were covered with chalk, the miner was face to face with great difficulties, and the capital required for working the measures was enormous. In the zone where water was found most freely, springs yielding as much as 4400 gallons per minute occurred. In the exhibition, however, there was a pumping-engine which would raise even 5500 gallons per minute to a height of 1970 feet. With regard to the depth of the measures, it was to be noted that at Dorsten, for example, the overlying strata amounted to 1970 feet in thickness, and elsewhere to 4920 feet. The pits would have in these cases to be carried to a depth of 5900 feet. These strata would not be worked in the near future. The carboniferous formation was now the productive coal zone.

Herr Grassmann then proceeded to discuss the conditions which affected the disposition of the coal seams, and referred to the different formations. In some beds only the so-called fat coal was present, while others contained only gas coals. In the south of the district, these divisions were sharply delimited, but farther north the two descriptions occurred in close proximity. After further reference to the strata, he pointed out that the group of gas coals occurred chiefly in the Stoggenberg and Emscher beds. Gas coals were found only to a limited extent in the Bochum and Dortmund beds; and so far as the north was concerned, only at Bochum. The length of the field worked at Stoggenberg was 13 miles, and its width rather more than 1½ miles. The northern bed of the Emscher and the southern portion of the Stoggenberg bed were especially well developed. After a few words on cannel coal, he proceeded to speak of the productiveness of the Ruhr coalfield, as to which numerous calculations had been made at a time when a coal famine seemed imminent. But actually such a famine had never really existed, and had only been pictured by alarmists. The output could be increased to double what it had ever been hitherto. Counsellor Schulz, the mining expert, had many years ago made a computation for the Chamber of Deputies of the store of coal in the Ruhr district. To a depth of 2300 feet there were 11,000 million (metric) tons; between that depth and 3300 feet, 18,300 millions; while going down to a depth of 4900 feet, there were a further 25,000 millions. In consequence of the development of the iron industry about the middle of the last century, coal mining had been able to expand so freely that there were now 117 firms engaged in it (in the district in question), of which 35 were limited liability companies, 80 companies without limited liability, and 2 were private owners. In the year 1901, 59,460,000 metric tons of coal were raised by 236,790 workpeople. In 1900, which was an especially good year for mining, 60,190,378 tons were raised by 220,031 workpeople. In 1901, the average amount of wages paid per (metric) ton of coal raised was 4·88 marks (4s. 10½d.); while in 1900 it was 4·92 marks (4s. 11d.). The prime cost per ton had amounted on the average to 8s. 1½d. and 8s. 2½d. per ton for these years respectively. The quantity of coal raised per man engaged at the pits was 270 to 280 metric tons per annum.

Herr Grassmann next referred to the Rhenish-Westphalian Coal Syndicate, to which 85 firms belong; and he declared that their association, if pursued too far, was a mistake. He sought, however, to refute the reproach, which was always raised in the Press, that the output of the Syndicate was intentionally kept down. Continuing, he enumerated all the pits from which gas coals were raised, and pointed out that the "Fürst Bismarck" pit was especially good. Other papers read on Wednesday were the following: "The Erection and Working of Settings of Inclined Gas-Retorts," by Herr E. Merz, Manager of the Cassel Gas-Works; "Distillation Coke-Ovens," by Herr Hilgenstock, of Dahlhausen-on-Rhine; "The Working Results of Electricity Works and the Prime Cost of Current," by Herr F. Ross, of Vienna; and "Notes on Incandescent Gas Lighting and High-Power Burners," by Herr H. Drehschmidt, of Berlin. The members were later given an opportunity of visiting the coke-oven works described by Herr Hilgenstock.

VISIT TO THE CITY WATER-WORKS.

On Wednesday evening, about 1000 of those attending the meeting went up the Rhine on a finely decorated pleasure boat to see the water-works of the city of Düsseldorf. These afford good testimony, like the other municipal works, to the excellence of the town's administration. Four pumping-stations normally deliver about 80,750, 84,500, 246,000, and 352,000 gallons per hour respectively. From the pumping-stations the water is conveyed through four sets of mains, 16½, 16½, 16¾, and 23½ inches in diameter respectively, to the areas of supply and the elevated reservoirs. The area supplied comprises the town district of Düsseldorf, and the neighbouring parishes of Ludenberg (a village of about 3000 inhabitants), Gerresheim (a small town with a population of about 4000), Eller (a commune, population about 4000), and Oberkassel (a small place on the opposite bank of the Rhine). The elevated reservoirs are on the height of the Grafenberg, and their bottoms are 185½ feet above the Düsseldorf high-water mark. They have a total capacity of 1,584,000 gallons,

Almost all the inhabited parts of the area are connected with the water supply. On March 31, 1901, the number of properties supplied amounted to 10,805. Of these, 8523 were consumers supplied by meter; while for the rest the consumption was estimated. The amount of water furnished in the year 1900-1 was about 1956 million gallons. The maximum day's output was nearly 9 millions; the minimum nearly 2,900,000 gallons; while the average delivery was about 5,360,000 gallons. The total length of the distributing mains is 125⅛ miles; and their capacity is 130 million gallons. The water is always of uniformly good quality, perfectly clear, and moderately soft. Bacteriologically, also, it stands well. Owing to its high degree of purity, it likewise does not produce incrustations. The total expenditure on the works up to March 31, 1901, amounted to about £240,080, of which, however, £179,524 had been extinguished by successive repayments. The gross profit for the working year 1900 was nearly £34,366; and after writing off the usual amounts, there remained a profit balance of £14,757.

On Thursday, before proceeding to the programme for the day, Dr. H. Bunte, of Carlsruhe, made some remarks on the "Purification of Gas." He specially referred to the purification of coal gas by means of the addition of oxygen or air.

Annual Report.

Then followed the presentation of the report for the year, from which the following details are taken: The Association for some time past had addressed communications to the proper officials of the Empire, with reference to the scheme for a fresh Customs' tariff, with a view to securing a revocation of the prohibitive duty on the so-called gas oils, or mineral oils which were suitable for the manufacture of carburetted water gas. Finally, applications had been made with reference to this matter to the Federal Council, but an answer had not been received to the memorial. Further, a comprehensive report had been presented to the members of the Committee appointed to settle the Customs' tariff. In this was pointed out how unfairly the tariff favoured the small brown coal (lignite) oil industry of Saxony and Thuringia in comparison with the far-reaching gas industry, which had its development curtailed by the high duty on oil, and was greatly injured thereby. No result, however, had up to now come from these representations. According, however, to an announcement by the Secretary of State, special consideration of the whole question of the duty on oil would shortly be undertaken.

The Royal Prussian experimental and testing station for water supply and sewage disposal had been opened in Berlin under the supervision of the Medical Counsellor, Dr. Schmidtmann, and the direction of Professor Günther. "The Association for Water Supply and Sewage Disposal" had also been constituted. The Association had participated in the International Engineering Congress at Glasgow, to the Gas Section of which a member of the Council, Dr. Leybold, had presented a communication. In regard to schools for gas-fitters, the instructors at the gas-fitters' school at Dessau had been engaged in drawing up a general course of instruction. In Carlsruhe, there was held, from the 19th to the 25th of April, a course of practical training for engineers. The twenty-second collection of gas statistics comprised the results from 218 gas undertakings for the working year 1900 or 1900-1. For the most part, also, a very considerable increase in gas production was shown. Among large works, the increases over the production for the preceding year were, for example: The Berlin municipal works, 393¼ million cubic feet; the Corporation works at Cologne, 127⅞ millions; the Hamburg Municipal works, 124½ millions; the Charlottenburg works, 108 millions; the Düsseldorf Corporation works, 64⅝ millions; and the Breslau works, 60½ millions. The continued increase in the use of gas for cooking and heating almost everywhere has, the report says, contributed very much to the general increase in the consumption of gas, which is illustrated by the foregoing figures.

The Association now numbers 830 members of all classes, which is an increase of 49 over the total for the preceding year. It comprises 2 honorary members, 679 members, and 149 associates. The report gives detailed accounts of the activity of the eight District Associations which are affiliated. Generous contributions have been made during the year by large firms and works to the support of the scientific labours of the Association. The capital of the "Schiele" foundation stands, as last year, at £1090. The total amount of the endowments received, according to the report of the Committee, is about £300, as compared with £266 the preceding year. The capital of the endowment fund amounted, according to the previous year's report, to £4025, and an addition of £250 was made to it. The receipts of the Association amounted to about £1574, and the expenditure to about £1350.

The reports of the various Committees of the Association were presented. That of the Photometric Committee, presented by Herr Thomas, Manager of the Zittau Gas-Works, stated that the demand for the Associations' standard candles for photometry had remained as great as in the preceding year, despite the continually extending use of the Hefner lamp. Consequently, a fresh batch of the candles would have to be prepared, and carefully tested. The Committee on Heating was granted £100 for the purpose of enabling it to draw up rules for the fixing and testing of gas heating apparatus, &c. The Committee on Gasholders had had two editions printed of the report which was presented to the meeting at Vienna last year, and approved by the Association, on a "Standard Specification for Supplying the Ironwork of Gasholders."*

The report of the Committee on Water Supply Statistics stated that Part XIII. of the statistics, dealing with the year 1900-1, would shortly appear. The report of the Committee on Water-Meters was presented by Herr W. H. Lindley, of Frankfort-on-the-Maine. He also presented the report of the Committee on "The Establishment of Regulations for the Protection of Gas and Water Mains from Stray Tramway Currents." The negotiations conducted with the Committee on Earth Currents of the German electricians, with the object of settling precautions for laying the rails of electric tramways, have not yet led to any result. Herr W. von Oechelhaeuser, of Dessau, presented the report of the Committee on Technical Instruction.

The results of the election of officers of the Association for the ensuing year were as follows: President, Herr E. Beer, Manager of the Berlin Water-Works, who has already held the office for two years; Vice-Presidents, Herr H. Grohmann, of Düsseldorf, and Herr W. Drory, of Frankfort-on-the-Maine; Committee, Herren Leybold, of Hamburg, Reichard, of Carlsruhe, Söhren, of Bonn, Schreyer, of Halle-on-Saale, Waltmann, of Charlottenburg, Kemper, of Dessau, Kohler, of Metz, and Ehlert, of Stuttgart.

Invitations had been received from both Dresden and Zürich for the meeting of the Association next year. It was resolved to accept the invitation to Zürich.

[The continuation of our correspondent's article relative to the proceedings at the meeting will be published next week.]

THE QUESTION OF BOILERS AND STEAM FUEL.

The problem of mechanical engineering for the present is the water-tube boiler. So much is to be gathered by every newspaper reader with respect to the boilering of the Royal Navy; but all works engineers and factory managers are well aware that the question of what is the best boiler for generating steam power is not confined to the case of His Majesty's ships. As usual, counsel in this regard has been sadly darkened by the intrusion of prejudice into what might reasonably have been expected to be a purely rational inquiry. Certain prominent Members of Parliament, and several usually well-informed newspapers, have made themselves notorious in this connection by the headstrong fashion in which they have espoused sides, which they have defended with much virulence and many of the methods of partisan warfare. This is extremely regrettable; inasmuch as prejudice is the last element that can profitably be introduced into an attempted solution of an engineering problem. The perfect engineer was once defined by an eminent exemplar of the profession—Dr. A. B. W. Kennedy—as a man who is always being called upon to "make up his mind." And this is a sufficiently troublesome and onerous exercise when he has a completely open mind to start with. It becomes almost a vain task, so far as concerns the value of the result arrived at, when the mind is not free from original bias, but is burdened with the embarrassing charge of working to a foregone conclusion. It is enough to remark, on this head, that all such conclusions are hopelessly "suspect," in the judgment of all other engineers before whom they afterwards come.

It is, therefore, a serious annoyance to others than naval engineers that the boiler question should be treated as it is in the newspapers. For the great election between the old familiar servant and the new help, between the cylindrical fire-tube boiler which in its varieties so long represented British practice in steam raising for all purposes, and the water-tube boiler, has now to be made at some time or other by every works engineer, as it has been by the engineering advisers of the Admiralty; and there is not one such responsible agent of capitalist manufacturers who is not troubled, in addition to his other worries in regard to the matter, by the spectres of the parliamentary agitators of the question. It is not as if the semi-political intermeddlers in this problem were content to let their pet solution lie with the Navy men. This is precisely what they will not do. The Navy boiler experts would be glad enough to let other grapplers with the question alone, to find their own answer to it; but those who condemn naval engineers for giving preference to the type of boiler that appears in their judgment to best suit the needs for which they have to provide, do so on the express grounds that other engineers think differently. Consequently, every works engineer ashore who inclines to put in a water-tube boiler when he wants more steam, or is laying down new steam plant, has to run the gauntlet of objection from those of his directors who happen to think in a vague amateurish sort of way that the Navy is ill-advised in taking this course.

It therefore appears to be a fit time for reviewing the boiler question, with special reference to the views and requirements of

* See "Journal," Vol. LXXIX., p. 634.

gas managers and other heads of manufacturing industries who now find themselves at the parting of the ways in this branch of their practice. It is no longer a matter of routine for works managers who do not pretend to be specialists in steam engineering, to put in Lancashire boilers made to some standard specification approved by a Boiler Insurance Company. That was what it had come to, at the high-water mark of the vogue of the fire-tube boiler; but within the past year or two, even when the Lancashire type of boiler had entered upon its highest technical pitch of excellent development, the change came, and it began to lose favour in the eyes of those who once admired it for its merits. Let it be said at once that those amateurs of the subject, and the "practical men" who can never see an inch beyond their nose, who have fallen into the trick of abusing the English Admiralty for preferring the water-tube to the fire-tube boiler in opposition to the bulk of mechanical engineering opinion, are in error. The Admiralty did not begin it. It is difficult, doubtless, to say exactly who did revive and adapt to modern requirements this very old type of steam generator; but it was probably Thorneycrofts and Yarrow as much as anybody. For some years past, however, as the record of the Babcock and Wilcox Company suffices to prove, the peculiar merits of this type of steam generator have been steadily forcing it into general use, to the supersession of the cylindrical fire-tube boiler—Cornish, Lancashire, Scotch, or locomotive.

This is a progression the philosophy of which everybody who has to do with steam should endeavour to understand. It is difficult for the "practical man" to do so, because he is so apt to boggle over the first indubitable, and apparently indigestible, "fact" that strikes him as being of cardinal importance in regard to such an issue. This fact here is the superior fuel economy of the fire-tube boiler. It is the weakness of the so-called practical turn of mind to look for single-term solutions of all problems. Then having got hold of one truth of a matter, it straightway falls into the heresy of believing that this is the whole truth of it, after which nothing else counts. Now, the truth as to the excellence in fuel economy of the fire-tube boiler is emphatically not one of those which can be safely taken away from all its conditions, and used, like a brick, to demolish an adversary withal. Starting with the assumption that no other form of steam-raising appliance was to be considered as available—which was good enough to be held by British engineers for two generations—their inborn genius for making the best of everything directed them to the improvement of the Lancashire boiler in every sense. There was always a great deal of guesswork about this proceeding, as witness the introduction and the abandonment of the "Galloway" tubes in the flues. Endless were the discussions about "circulation." Controversy, never settled, raged as to whether the course of the furnace gases, after going through the fire-tubes, ought to return to the front underneath the lower side of the shell and away by the sides, or return by the sides first. At any rate, putting it shortly, at last it came to this: That for a working pressure which for many years did not exceed 50 lbs., and with suitable fuel for the dimensions and situation of the fire-grates, the plain Lancashire boiler, working at a steady gait, did its evaporation at a consumption of coal or coke, which was accepted as the standard of economy. At least, there was nothing better.

Upon top of this, engineering opinion was confronted with the suggestion to use a kind of boiler which certainly burnt more fuel for the work done. It is no wonder that the "practical" mind revolted against such a proposition. It was certain to do so. Over and over again in the history of mechanical invention this point of comparative cost, so clear and so obvious, has been a stumbling-block in the way of progress. Apart altogether from the equally obvious consideration that the innovation, with all the rawness of newness upon it, must usually compare in many respects unfavourably with the system it aims at superseding, and frequently so in point of first cost or running expense, persons who reasonably attach importance to the question of economy are liable to overrate its determining value. The obvious economy is not everything. It was our experience some little time ago to come across a number of an old Mechanics' Magazine, about contemporaneous with "Pickwick," which described the then-known methods of obtaining fire; and the opinion was expressed that the extreme cheapness of the method of flint and steel removed all chance of its being superseded. Within a few years, the much costlier "lucifer" match had relegated all the tinder boxes to the rubbish heap. Gas managers do not need to be reminded that the doubt as to the superior economy of machine retort stoking in gas manufacture long retarded the undertaking of those large-scale experiments, directed with the intention of succeeding, which were necessary to prove the capabilities of the idea. At this moment, factory managers are perplexed over the question of electric power transmission on the same ground. A high degree of interest therefore attaches to the recent conversion of the Horseley Company, of Tipton, to electric driving—generating the electricity on the works by gas power. This action of the Horseley Company illuminates rather luridly the prospects both of the Mond Gas Company and the Midland Electric Power Company.

To return to the question of boilers. Economy of fuel, as we have seen, is not the critical matter the practical mind (reinforced in this regard by considerations which commend themselves to such as are solicitous for the husbanding of the fuel resources of the country) is prone to think it. And this for several reasons: In the first place, engineers who are themselves practical enough, but are also in the habit of looking below the surface of things, know very well that it is not the highly economical performance that constitutes the record, but the ordinary, everyday working of furnaces, that is chiefly to be regarded. It is all very well to talk about getting an indicated horse power for a very little over 1 lb. of selected coal burnt on the fire-bars; but the manufactures of the country are not carried on upon such terms. More important still, such critics are well aware that the high-water mark of fuel economy is only reached when fuel, furnaces, boilers, and engines are exactly balanced to one another—when the fires are very clean, and burning very nicely and quietly, and there is no hurry. But things are not always so comfortably disposed; and the Lancashire boiler will not stand being trifled with, or driven hard.

The last-named consideration lets in the whole of the qualifying conditions which the water-tube boiler is designed to cope with. How it copes with them is a question of the comparative excellence of the various forms of the appliance; but they all share certain well-defined characteristics which do not belong to the Lancashire boiler. It is not our intention to write a treatise on water-tube boilers, which would require a volume to do the barest justice to the subject; but inasmuch as we came to the end of the Lancashire boiler's virtues somewhat suddenly, it is only fair to put, with similar brevity, the meritorious points of its rival. Whereas the furnace capacity of the Lancashire boiler is strictly limited, with a consequent limitation of its steaming capacity and restriction to a high-class fuel, the furnace of the water-tube boiler may be of any desired dimensions, construction, and situation, and may be adapted to burn any class of combustible. To put it in another way, a good water-tube boiler may be forced to double its ordinary power at a pinch, which is not the case with the Lancashire boiler. It will also quickly respond to forcing, because it contains a small quantity of water; whereas the contrary conditions exist in cylindrical boilers. The heavy load of water in a Lancashire boiler is an element of serious risk in the working which is absent from the water-tube boiler. A cylindrical boiler, whether tubular or not, is to the water-tube boiler like a bombshell to a squib for potentiality of mischief.

Besides, the moment that one begins to expect more of the fire-tube boiler than steady steaming at about 50 lbs. pressure, troubles arise, and the imperfections of the type betray themselves. A plain, cylindrical boiler can be carefully worked up to 100 lbs. or 120 lbs. pressure, if it is built for it; but not to 200 lbs. or 220 lbs. without distress. Leaks of mysterious origin appear long before the ultimate safe working pressure is attained; and these mean nothing else than unequal heating and straining of the huge fabric. The furnaces are in the middle, and there is too great a difference between the heating of the upper and lower halves of the cylinder. Consequently, rivets fizzle, and seams weep; and there must be a stoppage for repairs. It is no small job to let down a big Lancashire boiler from 150 lbs. of steam pressure to the cold, and fire it up again. The dimmest perception then begins to see that the weights to be moved are excessive. There is a superfluous load of water for the proportion of steam taken off; and the great weight of iron is required to hold the water, not to facilitate the generation of the steam. Now, it is no part of the steam-user's requirements to keep up unnecessarily large reserves of boiling water, which are cumbersome at best, and veritable volcanoes at worst.

(To be continued.)

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 44.)

THE tragedy of the week—when, in the midst of rejoicings and preparations for festivity, England was instantaneously plunged into grief and apprehension—had no practical part in arresting business on the Stock Exchange. For weal or for woe, the decree had gone forth that it should be closed on the last three days of the week, and so it had to remain—Coronation or no Coronation. The business of the three open days was practically restricted to the settlement of the short account, and fresh commitments were postponed until the reopening. Matters were going along quietly and smoothly with a nice firm tendency, when, about midday on Tuesday, the postponement of the Coronation, and its tragic cause, became known. The consternation produced by this thunderbolt from the blue completely paralyzed action for a while, and, unable to gauge the situation, dealers promptly put down the price of everything. However, with business almost at a standstill, not much result came of it. By Wednesday, people were recovering from the shock, and looking at things more calmly, and so the week closed. In the Money Market, there was a strong demand for Stock Exchange settlement purposes, and for the usual requirements at the close of the half year; but discount rates were rather inclined to be easier. In the Gas Market, business was extremely limited, and the united transactions of all three days would only suffice to compose one ordinary day's operations. Still, there was a fairly numerous array of changes in quotation. These, however, were very irregular, as many being

in one direction as the other, just as chance circumstances might guide them, as there was no settled tendency. In Gaslight issues, the ordinary was steady, changing hands daily at prices ranging from 94 to 95. Of the secured issues, only the maximum was dealt in. It was in good demand and gained a point. South Metropolitan had a slight set-back after its recent advance, and the quotation receded a point. In Commercials nothing was done. In the Suburban and Provincial group, the only feature was the flatness of British, which also receded a point. There were very few transactions in Continental Companies; but in Union the ordinary was put up, and the preference put down. Nothing of interest occurred in connection with the remoter undertakings. Business in the Water Companies was fully as subdued as it has been of late; but still there were some changes in price—East London advancing, while Kent receded.

The daily operations were too insignificant for further detailed review. On Monday, Gaslight maximum advanced 1, and Continental Union ordinary improved 1; but ditto Preference fell 3. On Tuesday, South Metropolitan moved down 1, and British ½. In Water, East London rose 2; but Kent declined 5. Kent 7 per cent. was inadvertently marked up 10, but was put back again next day. On Wednesday, British dropped another ½. In Water, East London gained 1.

ELECTRIC LIGHTING MEMORANDA.

A Question of Power Supply—Antiquation of the Electric Lighting Act—An Example of Electrical Enterprise that Failed—The South Wales Electric Power Scheme—A New Station for Shoreditch.

An observation of Sir John Brunner, Chairman of the House of Commons Committee on the Rickmansworth Gas Bill, on the subject of the request of the promoters for permission to supply "power gas," may be commended to the notice of electricians and others interested in the rising antagonism between municipal trading and private enterprise. In striking out the application, Sir John Brunner remarked that it referred to a kind of enterprise which the Committee did not think should be appropriated in detail by small undertakers up and down the country. If a business of this kind were done at all, it should be on a large scale, covering a considerable area; and this would be hindered by the creation of small vested interests in the same service. There can be no questioning the wisdom of this judgment; but the mere fact of its having been given, shows how far the best public opinion of the country has travelled from the stage reached in 1882. At that period, Mr. Joseph Chamberlain received very general applause for recognizing the claims of local authorities everywhere to go in for electric lighting, if they chose, to the exclusion of companies who might covet their districts.

The Electric Lighting Act, 1882, with its jealous definitions of "Districts A and B," reads quite like some archaic record of a past stage of civilization compared with the present-day grandiose schemes of electric power distribution, which have counties for units. All the same, it is true that the rash abandonment of these narrow limits of compulsory supply by many local authorities is the reason for their financial distress. The St. James's and Pall Mall and the Westminster Electric Lighting Companies of London have been used as bait in many electrical prospectuses; but few have publicly noted that these concerns flourish because they are strictly limited to their respective areas and cannot extend. How it will fare in the long run with the big schemes which have to make their account with the exactly opposite condition, as regards districting, remains to be seen. Some of them may pay, but not many can do so. There is a terrible commentary on the contemporary cackle over the backwardness of British as compared with the expansion of German electrical enterprise, in a few words of Consul Stevens's report on the trade of Baku. He says that a year ago, when the oil trade was flourishing, certain Germans thought there was a fine opening for electric power in the district. Accordingly, a vast and really splendid installation was provided at a cost of about £1,000,000; only for it to be discovered that nobody wanted electric power. Therefore, the whole venture remains a monument of mistaken enterprise. The machinery has never been used; and the money it cost might as well have been thrown into the Caspian Sea.

It is sincerely to be hoped that no such unhappy fate awaits the pioneer electric power schemes of the United Kingdom, which are really *bonâ-fide* endeavours to yoke a new team to the car of British industry. Nobody cares what becomes of those hare-brained schemes of the same colour in which the names of a handful of notorious City electricians, lawyers, and financiers crop up again and again with irritating iteration. There is no need to "name names;" but it is reported that one of these persistent gentlemen is on the Board or connected with over forty electric schemes. This is not the kind of private enterprise that commands respect, or strikes a prudent man as deserving of support. A municipal trader is preferable to a "guinea pig," if only because the area in which he can do mischief is single, and limited. The South Wales Electric Power Distribution Company ought to succeed for a variety of reasons, of which the chief is that it is a purely local venture. The district should be a favourable one (if such there be in the whole country), comprising as it does all Glamorganshire and Western Monmouthshire. A start has been made with the power station at Pontypridd. The local authorities are not going to hurt the Company much; so that on the whole the prospects of the undertaking are of the best. It will be intensely interesting and instructive to follow the fortunes of the Company.

The electrical and municipal journals have been publishing glowing accounts of the opening of new electricity generating works by the Shoreditch Borough Council. The function appears to have partaken of the nature of a variety entertainment. The attractions of a brass band and a display of bunting were supplemented by those of a lively interchange of East-end compliments between local celebrities, which began when somebody was wicked enough to mention dust destructors. This put "the fat in the fire," and afterwards all the speechmaking was dashed with more or less acrid references to the past experiences of the borough with that notable combined scheme which was to supply steam for less than nothing and store it up until it was wanted. All this has been relegated to the past; and it must be cause for thankfulness to all concerned that the Shoreditch undertaking has outgrown the possibility of running it on experimental lines. The engineers for the new power station have ignored dust fuel and thermal storage, and fallen back upon steam generation after the general practice. Accordingly, the new station has Babcock and Wilcox boilers, of the new marine type, with accessories of the most improved kind for handling the coal. This is all very good, no doubt; but nevertheless it signalizes the departure of one more illusion. It seems ages ago since Professor G. Forbes interested the town with his curious inquiry into the possibility of lighting a populous city by means of its own dust-bin refuse; and this is the end of it—that there is nothing like coal fuel when one means business. Many years must elapse before another such experiment as the first Shoreditch plant can be tried again under new conditions. For if after all that can be said, the available heat of dust destruction is only going to save a municipal electric lighting plant a certain quantity of coal during the first eighteen months or so of its existence, which is now all that is claimed for it in the case of Shoreditch, the game is not worth the candle.

WELDLESS STEEL FOR GAS AND WATER PIPES.

At the recent meeting of the Ohio Gaslight Association, as reported in our issue for May 20, some discussion took place with reference to the use of wrought-iron gas-pipes (suitably coated to prevent corrosion) instead of cast-iron ones. Seeing that a good deal must depend upon the nature of the soil in which these pipes are placed, it was only natural that there should be some difference of opinion as to the best material to employ. Several members, however, stated that wrought-iron pipes, dipped in a protective solution, had proved satisfactory, and in many respects advantageous. This discussion aroused some interest; and it subsequently formed the subject of an article by Mr. Godfrey L. Cabot, of Boston, in the "American Gaslight Journal,"* in which the author, who visited nearly every country in Europe, and some of the larger cities in the States, in quest of information on the subject, expressed himself as being in favour of laying gas-mains entirely of wrought iron, using as far as possible malleable fittings. But at the same time he was of opinion that all mains laid under paved streets or in bad ground should be swathed in a double thickness of cloth soaked in coal-tar pitch. Even as regards the vexed question of the danger of damage from electrolytic action, Mr. Cabot believes that wrought-iron is at least as safe as cast-iron pipe, inasmuch as it furnishes a continuous conductor. While, therefore, so much interest is being taken in the question of the relative advantages of cast and wrought iron pipes, it may not be out of place to draw the attention of our readers to the fact that there is also another strong competitor in the field, in the shape of weldless steel tubes, the use of which is rapidly extending all over the Continent. There are at present hundreds of towns in Austria, Germany, Switzerland, Holland, &c., in which these tubes have been laid down, and have proved perfectly satisfactory to the authorities; a suitable coating being employed so as to render them quite impervious to rust.

Many advantages are claimed for weldless steel tubes, not the least of which is that they are supplied in lengths up to 30 feet—thus saving at least two-thirds of the connections required with cast iron, and at the same time adding largely to the safety of the main. They are, of course, unbreakable; and it is possible to bend them in the cold state on the spot, if required. Another important consideration, too, is that it is unnecessary to lay them so deep as must be done in the case of cast-iron pipes, as they do not suffer in the least from vibrations or subsidence of the soil, which are the causes of so much worry and anxiety to gas and water managers under the old order of things. In proof of the immunity of weldless steel tubes in this respect, it may be stated that they were on one occasion put to a very severe test in the town of Brux, in Bohemia. During the memorable subsidences which occurred in that town in the month of September, 1895, a

* See "Journal," Vol. LXXIX., p. 1422.

pipe-line of this description, manufactured at the Mannesmann Tube-Works, Komotau, remained quite intact, in spite of a fall of 31 inches over a length of 160 feet, and 53 inches over a length of 300 feet; while the inside pressure was 14 atmospheres, or about 210 lbs. per square inch. The behaviour of the cast-iron mains on the opposite side of the street was of a much less satisfactory character, for they snapped off in several places. Notwithstanding the fact that weldless steel tubes are much thinner in shell than cast-iron pipes, we are informed that no difficulty has been experienced on the Continent in tapping them for service connections; and this has also proved to be the experience in America with wrought-iron pipes.

In spite, however, of the many advantages which steel possesses for use in the distribution of gas and water, everything must depend upon the possibility of protecting pipes made of this material in such a way as to secure absolute immunity from corrosion; and the experience in Continental towns would appear to demonstrate conclusively that this problem has been satisfactorily solved. Special plant for turning out welded steel tubes in this country has been laid down by the British Mannesmann Tube Company, of Landore; and therefore there is no reason why English gas and water engineers should not test the efficiency of the method for themselves. To form the protective covering, the tubes, while hot, are dipped in a special preparation, and afterwards wrapped diagonally in juted cloth soaked in the same liquid; this, of course, being done at the manufactory. The joints can then be covered without any trouble, after the pipes have been laid. It is contended that this protection is sufficient to withstand any possible influence of the soil—in fact, the covering becomes harder and harder as years go by, forming a perfect coating for the metal, and leaving it entirely free from rust. All those who have (and who has not?) at some time or other experienced trouble owing to the giving way of the seams of welded pipes when bending has had to be done, would welcome the placing within their reach—as regards cost—of a system by which the need for any such apprehension would for the future be obviated. It is on the question of cost that we should now like to have some definite information.

THE "VERITAS" INCANDESCENT MANTLE.

The designations of "Veritas" and Falk, Stadelmann, & Co., Limited, have been so long united that it is not astonishing to find the latter applying the former to the new incandescent mantles which they are to-day introducing to the gas-consuming world, under a licence which they hold from the Welsbach Company. Strength, efficiency, and cheapness are the three pointed merits of the mantles; and what more can be desired? The base of the mantle is made of a specially prepared thread known in the mantle-making trade as Ramie. The thread in its original state is much finer than the cotton ordinarily used; but, after impregnation and finishing off, the mantle has a coarser appearance than those produced with the ordinary cotton fabric. But who cares whether a mantle has a rugged looking mesh when cold? The main points are to have a mantle of high efficiency, good shape, and possessing as much strength as can be put into it. Tests with these mantles show that they can be burnt off and yet stand rigid on a table without support. They will also bear a liberal amount of lifting on and off the forks; and further evidence of strength is given by the fact that not a single mantle has yet been found fractured in transit. Another attributed merit of a properly prepared Ramie mantle is that it will adapt itself to the flame, and retain its shape. If this can be positively relied upon, it will soon make Ramie mantles much preferred to the ordinary cotton ones, many of which quickly undergo a transmutation from a conical form to the shape of the back of one's thumb—that is to say, they soon develop a kind of "waist" just above the burner cap.

But turning now from rigidity and form to lighting efficiency. There is a curious point about these mantles that has been noticed in connection with certain others, and that is the tendency to ascend in illuminating power until an ultimate point is reached, and then to slightly decrease in power. Confirmatory tests have been made at the Imperial German Laboratory at Charlottenburg with the "Veritas" mantle; and the same thing in all cases has been observed. Here is an account of the progressive results obtained in one of the tests. The average illuminating power after six hours' burning was 73·6 English candles; after 100 hours, 80·8 candles; after 200 hours, 81·6 candles; after 300 hours, 82·4 candles; after 400 hours, 84·8 candles; and after 500 hours, 82·4. It should be mentioned that in the original report the illuminating power is rendered in Hefner units; but in the conversion 100 Hefner units have been taken to equal 80 English candles. This is to the disadvantage of the mantle, as the proper equivalent is 88 candles; but Messrs. Falk, Stadelmann, & Co. are desirous of being on the right side. In the makers' opinion, the explanation of the advance in illuminating power is that there is certain matter in a mantle which is gradually burnt off; and as it disperses or is destroyed, so the illuminating power rises.

The "Veritas" mantles are manufactured of two qualities and in five sizes, and are supplied at cheaper rates. The extra quality mantle is made of somewhat stronger material and impregnation, and is intended for use on burners of the types which soon mark with ill-effects ordinary mantles. There is very little difference in price, so that the second quality may become the more generally favoured of the two. It may interest our foreign readers to know that mantles purchased in this country for export are not subjected to the royalty payable to the Welsbach Company; so that, as a matter of fact, orders for mantles for export can be executed at a cheaper rate than orders for mantles for home consumption—of course, not taking into consideration the cost of carriage. As our readers are aware, Messrs. Falk, Stadelmann, & Co. have for many years supplied Welsbach goods; and we are asked to mention that, although they are introducing a mantle of their own, their business in Welsbach goods will continue as heretofore.

PERSONAL.

SIR GEORGE LIVESEY.

The whole gas profession, and all who have benefited directly or indirectly through the work of Mr. George Livesey in connection with the magnificent industry of which he is—by general consent—the recognized chief, will rejoice with us in the signal mark of the King's gracious pleasure in bestowing upon him the dignity of knighthood. The news was first made public, through the King's characteristic kindness, on the morning of the day which, but for a cause which all loyal subjects profoundly deplore, would have been His Majesty's Coronation day. It is safe to say that no man whose name appears in the list of those who have received similar honour has earned, in a more thoroughly noble manner, the right to royal recognition than Mr. Livesey; and it is equally safe to say that no man has had less thought of such a distinction than he to whom we to-day offer our sincerest felicitations.

This mark of the King's regard crowns with mundane glory an active working life founded and embedded in honour, and the superstructure of which is framed by self-sacrifice and built in with solid and useful service which has advanced in prosperity and strengthened in endurance a great industry. Mr. Livesey's working life has been entirely spent in and for the gas industry; and it has, in measure great or small, carried benefits, in its time, to all men who have come in contact with the industry at any of the many points of its requirements and products, and will continue to do so. Making at the time of writing a mental retrospect of his work, one fails to find a part in which does not run a vein of his powerful influence. In constructive and engineering work, and in administration in all its phases—from productive economy on the works, the treatment of all labouring with him as joint workers and men having identical interests, to purchasing and selling outside the works—his talents, skill, and experience have been brought to bear, ofttimes with a boldness which has excited surprise among many, and has, we venture to say, occasioned himself no little anxiety as to the issue. But few men, it may be confidently asserted, have had less disappointment in the accomplishment of beneficent purposes, which is a tribute to his foresight, power of reasoning and inception, and continence in the pursuit of his object. But above all we, and all who intimately know him, hold dear those altruistic instincts which have ever governed his actions, impulsive or considered.

To the full extent of their power, Mr. Livesey's professional contemporaries have honoured him; and it is only meet that the first external honour to a gas man whose life's interests are absolutely existent within the industry should be conferred upon Mr. Livesey. The lights of the sciences, arts, professions, and manufactures, have been dignified by their Sovereign in the past without stint; but a similar favour has never before found its way so directly to the gas industry. In honouring Mr. Livesey, His Majesty has conferred dignity upon the whole gas profession. Mr. Livesey's transparent character, one of the traits of which is his utter dislike of ostentation, permits us to say that he will wear his new title with as little personal regard as he has shown in occupying the eminent position which he attained long years since. The man we have known in the past will be the man we shall know in the future. The same work for the gas industry, and the same consideration for its welfare and all identified with it, will be given by Sir George Livesey with the same singleness of purpose, liberal-heartedness, and courage as heretofore so long as it shall please the Giver of all blessings to endow him with the necessary health and strength. We hope that Sir George will live many years to bear his new and distinguished title.

Since the above was written, the following letter has been sent for publication:—

Sir,—How well earned Sir George Livesey's title is can only really be understood by those who know the Chairman of the South Metropolitan Gas Company.

Everybody who is intimately acquainted with his real worth as a man must have been keenly delighted when they learned of the

great honour bestowed by His Majesty the King upon one who has done so much towards the emancipation of the working man. Sir George Livesey's intimate knowledge of the working man, and the tactful manner in which he deals with him, is the real secret of the success of profit-sharing. Introduced as it was at such a critical period—when trade unionism had established a firm and dangerous footing among gas workers, and the even-minded man was beginning to ask himself where it would end and make up his mind to join the Trade Union or starve—profit-sharing came and was his salvation.

How many men are there in the South Metropolitan Gas Company's employment to-day who were shareholders against their own inclination at first, but who have been taught to be thrifty only by the far-seeing, patient, and persistent persuasion of George Livesey? How many there are who owe their very existence outside the workhouse to his generosity is only known to himself. But these must all rejoice that his signal services to his fellow-man have been recognized by our beloved Sovereign.

June 26, 1902. G. E. W.

We are pleased to learn from the "American Gaslight Journal" that at a recent meeting of the Board of Trustees of the Stevens Institute of Technology, it was unanimously decided to offer the presidency of the Institute to Mr. ALEXANDER C. HUMPHREYS, in succession to the late Dr. Henry Morton, whose death was recorded in the "JOURNAL" for the 3rd ult. (p. 1481). Our contemporary states that Mr. Humphreys has not yet accepted this great trust officially, but there can be no doubt that in the end he will do so. We believe that an understanding as to the closing of the business affairs of Messrs. Humphreys and Glasgow is all that remains to be done preparatory to his occupying the presidential chair. Mr. Humphreys was a graduate of the Institute in 1881, was chosen a life member of the Board of Trustees in 1891, and becomes the Director in 1902. He has done much for the material welfare of the Institute; and we cordially unite with all his friends in wishing him success in a position which he is eminently qualified to fill.

OBITUARY.

IVISON MACADAM.

With feelings of more than ordinary regret, we announce that Professor W. Ivison Macadam and a student named James Bell Forbes were murdered in the laboratory at Surgeons' Hall, Nicholson Street, Edinburgh, on the forenoon of Tuesday last. The deed was committed by a janitor in the institution named Daniel M'Clinton. The Professor was in the uniform of a Brigade Major, in which capacity he was to sail from Leith in the afternoon in command of the Lothian contingent of Volunteers at the Coronation ceremonies. M'Clinton is an Army pensioner and a Volunteer. It is stated that he had a grudge against Professor Macadam, imagining that, on account of an arrangement for which that officer was responsible, he had lost the opportunity of making £3 in a shooting competition. Being in the habit of attending such meetings, no notice was taken of him by anyone when he entered the laboratory, carrying a rifle. He shut the door behind him, walked up the room to the farther end, where Professor Macadam and his brother were conversing with their backs towards the door. Suddenly he raised the rifle and fired two shots at Professor Macadam, who never even knew that he was being attacked till the fatal bullets entered his body. With an agonizing shout, he fell down and expired. The miscreant then pointed his weapon at an assistant, at whom he fired one shot, but fortunately missed him. He then turned upon Forbes, at whom he fired two shots, inflicting injuries of which the poor lad died in the course of the afternoon. M'Clinton was disarmed by Professor Macadam's brother, and was handed over to the police. The tidings of the awful tragedy, of course, caused the greatest consternation in circles where the unfortunate gentleman was known.

Professor Macadam was a teacher of chemistry in the extra-mural school of medicine known as Surgeons' Hall, and in the New Veterinary College, both of Edinburgh; and he was a highly successful analytical chemist. His scientific studies had brought to him the honour of Fellow of the Royal Society of Edinburgh, Fellow of the Institute of Chemistry, Fellow of the Chemical Society of London, and President of the Royal Scottish Society of Arts. But his interests were not confined to his profession. He was, as already stated, a Volunteer, rising to the post next the District Commander. He was a Freemason, and in that capacity he had held the offices of Grand Sword Bearer, Grand Director of Ceremonies, Past Deputy Grand Principal of the Supreme Grand Royal Arch Chapter of Scotland, and Past First Principal of Chapter 83. A Unionist in politics, he was a member of the Committee of Management of the Union Club. In all that he undertook he was ardent and enthusiastic; and he made friends wherever he went. Though he did not directly belong to the gas industry, he was very much in touch with it, and took a kindly interest in all that pertained to it. His taste in this matter was probably inherited from his father, the late Dr. Stevenson Macadam, whom he succeeded at Surgeons' Hall. Their primary interest in gas was the training of young men who were destined to occupy leading positions in the industry; but in the case of both father and son, their interest went much further. They were both contributors to the work of Associations of Gas Managers, where they were warmly welcomed. For these services Dr. Stevenson Macadam was elected an honorary member of the North British Association. He died in the course of the winter before last; and at their meeting in Glasgow last July, the members of the Association unanimously extended the same honour to the son. In acknowledging it, Professor Macadam expressed his intention of keeping up the cordial relationship which had existed between the members and his family in the past—a resolution which fate has prevented him from carrying into effect. Professor Macadam was in the habit of contributing a lecture to the Irish Association of Gas Managers, at their annual meetings; and, in recognition of the valuable aid he gave to the Association, they also elected him an honorary member. With his usual heartiness, he had promised a lecture for the meeting of the Association in Cork next month; and, in a genial letter to Mr. Whimster, he expressed the hope that he might be present, and be able to see and handle the Blarney stone. He was seen at his best at the Irish meetings. There was Irish blood in his veins; and he delighted to rove through the country, making inquiries everywhere into historic and antiquarian subjects.

It was characteristic of Professor Macadam that he was always in search of knowledge. Even his holidays were arranged with a view to study, which was his work; for recreation he turned to popular lecturing, Volunteering, and Freemasonry. Had his life been spared, he would certainly have attained a position of great eminence, in his profession and otherwise. He has been untimely cut off at the early age of 46, sincerely mourned by many. His remains were interred in Portobello Cemetery on Thursday afternoon, with military honours, and in the presence of a very large and representative gathering of citizens.

The death occurred at Campbeltown on the 17th ult. of Mr. WILLIAM ROBERTSON (Manager of the Corporation Gas-Works), in his 70th year. Mr. Robertson in earlier life superintended important contracts in connection with the erection of gas-works in Malta, Australia, and different parts of Ireland. He came to Campbeltown from Londonderry, where he was Gas Manager about thirty years ago. Mr. Robertson was one of the best amateur floriculturists in Scotland.

We regret to announce that Mr. J. C. ADAMSON, of Airdrie, died very suddenly, at his residence in that town, on the forenoon of Tuesday last. He was an honorary Sheriff-Substitute of Lanarkshire; and in that capacity he attended the installation of a new Sheriff-Substitute in the Court House. Walking home with a friend, he fell down at his own door and expired. Mr. Adamson was a native of Fifeshire, and in his early days was Manager of the gas-works at Leven. He was afterwards Manager of the Galashiels Gas Company. So far back as the sixties, he went to Airdrie to manage an oil refinery, which was not a success; and he started the Standard Foundry there. This he soon converted into the Airdrie Iron Company, which still exists as a private concern. Latterly he had felt the burden of advancing years, and assumed as partner Mr. Barman, by whom the business is being carried on. Mr. Adamson possessed the distinction of having been the first Secretary of any Gas Association. He was present at the meeting of gas managers held at Kelso on Aug, 5, 1861, at which the Waverley Association was founded, and was appointed Secretary. He afterwards attended the meeting in Edinburgh, at which the Scottish Association of Gas Managers (now the North British Association), of which he afterwards became an extraordinary member, and remained so to the last, was formed. He was thus an original member of both the Waverley and North British Associations. A man of untiring energy, widely read, a fluent speaker, and possessed of illimitable *bonhomie*, he was a tower of strength to every meeting in which he took part. His delight was the gatherings of the Waverley Association. He was unable to attend last April, and his presence was greatly missed, more particularly as the meeting-place was Kelso, which was the scene of his first connection with the Association.

According to the Copenhagen correspondent of the "Daily Express," there seems to be a probability that at last the coal-fields of Spitzbergen are to be adequately worked. The Norwegian Company formed last year have issued stock to the extent of £20,000, and with this capital they intend to carry on mining operations. It is estimated that £10,000 will be sufficient to cover everything which may be deemed necessary in the way of plant for the thorough carrying out of the work. About fifty or sixty miners will be employed; and they are expected to get out from 75 to 100 tons of coal daily. For the present, it is proposed to transport the coal to Drontheim and the most northern places in Norway by steamships; and it is said that it can be landed there at between 8s. and 10s. per ton. Spitzbergen coal has been tested chemically, and tried on railways and in manufactories; and it is found to give full satisfaction.

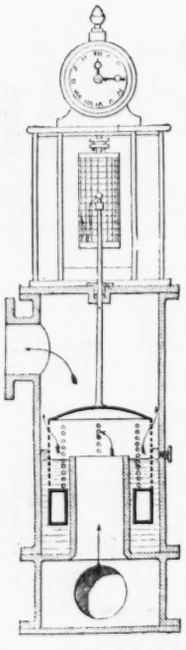
NOTES.

The Performance of the Diesel Oil-Engine.

It is reported in the "Engineer" that the Diesel oil-engine, of which so much has been heard from Continental sources, has been on trial since the beginning of the year for pumping Harrogate sewage. The contract price of the 32-horse power Diesel engine was £708, and the actual cost of the installation, including pump, foundation, belting, and other sundries, came to £1022, of which about £900 was due to the engine itself. The plant is estimated to run seven hours per day at 32 brake horse power, and sixteen hours per day at 16 brake horse power, for 300 days in the year. Two men's wages are allowed for, as well as 4 per cent. for maintenance and repairs, and 6 per cent. for interest and sinking fund. Owing to difficulties of transport to the site of the sewage pumping plant, the oil at present costs 85s. per ton. Under these conditions, the Borough Engineer, Mr. Wilkinson, finds the annual cost to be £440, or almost exactly ¾d. per brake-horse-power-hour. In this cost, the oil accounts for over £160; and if only one-half of this somewhat extravagant cost could be saved, the cost of the brake-horse-power would be reduced to under ½d. This includes all the costs due to the pumps as well as of the engine. For the purpose of making a comparative estimate of the cost of pumping a unit of 20,000 gallons against a head of 100 feet, Mr. Wilkinson assumes the above cost of the Diesel plant as unity. Then the cost of electric pumping, with current taken from the mains at 1d. per unit, would be 1·44, an ordinary oil-engine 1·7, and a gas-engine 1·65. The calculations were made on the same bases in respect of capital and working expenses, except that no wages at all were debited to the electric plant, which therefore stands really higher in cost than the figures show. The items put down for interest and sinking fund in the four cases were in the ratios—Diesel, unity; electric, 0·39: oil-engine, 0·66; and gas-engine, 0·58. These ratios certainly did not favour the Diesel engine, which is an important consideration, inasmuch as they account for about one-seventh of the total expenses.

Automatically Recording the Delivery of Gas.

Our readers may remember that at the meeting of the Société Technique du Gaz en France at Dieppe last year, M. Lacaze read a paper on "The Automatic Enrichment of Gas by Benzol," a translation of which was given in the "JOURNAL" for the 6th of August (p. 339). At the close of his communication, the author stated that the output indicator, forming part of the plant employed, could be utilized to record the quantity of gas being sent out during the day. The indicator has since been set up for this special purpose at the Chantilly Gas-Works. It was shown in the series of diagrams accompanying the paper, but it is here reproduced to a larger scale, whereby its operation will be easily understood. It will be seen to consist of a perforated bell which rises and falls according to the pressure put upon it. The course taken by the gas is indicated by the arrows; and the perforations accord with various rates of delivery. The positions of the bell at different times during the day are marked on a paper placed upon the revolving drum shown beneath the clock; and the diagrams obtained at Chantilly indicate clearly the periods of maximum and minimum consumption. The apparatus is capable of recording anything up to 14,000 cubic feet per hour; whereas the greatest make at Chantilly never exceeds about 3000 cubic feet. The fact that the appliance gives accurate indications for outputs of gas which are so much below its maximum capacity is regarded by M. Lacaze as a clear proof of its sensitiveness. It could be made portable, and, if placed at different points on a main, would furnish precise data as to the adequacy or otherwise of its capacity.



The Straker Steam-Lorry.

As gas managers throughout the country are having their attention called to the desirability of substituting mechanical for horse haulage, it should be recorded that the winner of the prize of £100 offered by the War Department for steam-lorries to be tried at Aldershot was the make of the Straker Steam Vehicle Company, which burns coke. In this lorry, which conveniently takes a trailer, a special design of water-tube boiler is used, working at a steam pressure of 200 lbs. per square inch. The evaporative duty is stated to be 8 lbs. of water per pound of coke. The engine is a compound horizontal, with 4-inch and 7-inch cylinders, running at 400 revolutions a minute, developing from 30 to 35 indicated horse power. The vehicle measures 18 ft. 6 in. by 7 ft., extreme dimensions. The driving part is in front, and is carried on pivoted wheels, with wheel steering. The Aldershot trials continued for ten consecutive days; the competing vehicles being required to do daily journeys of nearly 40 miles without stops for any purpose. Gradients of 1 in 6 were met with, and all kinds of soil, from the hard high-road to bog in which the wheels sank 12 inches deep. A full level mile was done in 5½ minutes with a 5-ton load. The running costs are taken as follows, for a working year of 260 days, every day's work being the hauling of 5 tons a distance of 50 miles: Total fuel consumption, about 70 tons of coke; drivers' wages, £91; repairs, £25; oil and petty stores, £10; insurance, housing, water, &c., £22; making a total of £192 for running expenses, which works out to only 0·7d. per ton-mile—a figure hard to beat. There are several good points about this vehicle, which is stated to be exceedingly neat and strongly made. Both the steam and the exhaust are superheated, with the result that there is no water ejected, and the steam is only visible in very frosty weather. There are two speeds. The lorry can also be made to tip if required. Steam omnibuses are made on the same principle, and are stated to run, everything in, at a cost of 4d. per mile, which is about half the cost of electric tramway traction.

Facilitating the Scurfing of Retorts.

As already briefly mentioned in the "JOURNAL," M. Dulac described in a short paper prepared by him at the recent meeting of the Société Technique du Gaz en France, a retort-scurfing appliance which has been adopted at the Besançon Gas-Works. Owing to the engine and boiler house being situated at some distance from the retort-house, it was not deemed advisable to incur the expense of laying down pipes for removing the carbon from the retorts by means of an air-blast, and refractory tiles (which were rather costly) were employed. Lately, however, the difficulty has been overcome by carrying ½ and ¾ inch iron steam-pipes above the fronts of the settings, at about the height of a man, provided at intervals with stopcocks to allow of a supply of steam being taken off. To each of these stopcocks a flexible pipe, made of bronze and asbestos, and connected with a Körting injector, may be readily attached. Being mounted on a kind of portable framework made of iron tubing, the blower can be easily moved to the front of the retort which requires scurfing.

The Cost of a Central Acetylene Installation.—In answer to a correspondent, the "Acetylene Gas Journal," of Chicago, has recently published the following estimate of installing a complete acetylene plant for a "town of considerable size" (apparently about 1000 inhabitants and 150 private customers), the generator being non-automatic: Building for generators, tools, storage, &c., $250; generators, foundation, piping, and erection, $200; 2500 cubic feet holder, $2000; 1000 feet of 3-inch pipe, at 33c., $330; 7000 feet of 2-inch pipe, at 17c., $1190; 5000 feet of 1½-inch pipe, at 12½c., $625; 3000 feet of 1-inch pipe, at 6c., $180; laying, testing fittings, refilling, &c., at 10c. per foot, $1600; 150 feet of ¾-inch service-pipe, at $8, with labour, $1200; 150 meters, at $5·50, $825; 35 iron lamp-posts, complete, $700; incidental expenses, $300; profit to erector, $1000—total, $10,400. If the plant supplied 150 customers within a radius of three miles, and produced, on an average, 1600 cubic feet of acetylene per day, the working charges should be: Carbide, at $70, $336 per month; labour, carriage, water, office expenses, and lighting street-lamps, $150; leakage, depreciation, and taxes, $25—total, $511 per month. Revenue: Acetylene, at $15, $688·50; public lamps, at $18 per lamp-year, $52·50—total, $741 per month. This represents a profit of $230 per month, or $2760 per annum, which is a return of 26½ per cent.

Development and Cost of Incandescent Street Lighting in Zurich.—The great development of incandescent gas lighting in Zürich, where it has been in full use in the whole town district since November, 1901, is shown by the following figures: For public lighting in the year 1891, there were used 1686 lamps, each with one open-flame burner; and in 1896, 3307 lamps, with 3465 burners. In 1902, there were 5530 lamps, with a total of 6866 burners. The amount of light afforded, stated in English candles, is as follows: Dec. 31, 1891, 1686 burners of 14-candle power = 23,604 candles. Dec. 31, 1896, 3465 burners of 14-candle power = 48,510 candles. Dec. 31, 1901, 6866 burners of (about) 44-candle power = 302,104 candles. The increase in the number of lamps has caused a corresponding rise in the cost. Thus, for the public lighting, the expenses for gas consumed, wages, and maintenance were in the year 1891, £3950; in 1896, £9330; and in 1901, £17,930. The town of Zurich has, in proportion to its population, a very extensive district to light. The length of streets lighted is some 180 miles; so that about 31 lamps go to a mile, the average distance apart of the lamps being about 55 yards. The lamps on tramway routes have two burners each; but on moonlight nights only one of these is lighted. The public lighting is looked after by a staff of 86 lamp lighters and cleaners, under the control of the Engineer of the gas-works. Since 1899, experiments have been made with the so-called lamp-clocks for automatically lighting and extinguishing the lamps. There are 111 of these appliances in use; and so far they have, generally speaking, proved very satisfactory.

COMMUNICATED ARTICLE.

SUNDAY REST FOR GAS WORKERS.

By "Amicus Curiæ."

The thanks of all interested in this question are due to Mr. Shadbolt for the immense amount of labour involved in the preparation of the paper read at the recent meeting of the Gas Institute, and which constitutes an exhaustive treatise on the present position of the subject. The expression, "all interested," includes not only managers, directors, and shareholders, or, in the case of municipal ownership, the whole of the ratepayers, but also the men themselves. The paper and discussion were, to use Mr. Durkin's expression, decidedly "managerial;" and to get a complete exposition of the subject, it should be supplemented by the views of the owners who find the money, and by those of the men who do the work. The expression "gas workers" includes lamplighters, foremen, and managers; but by common consent it was confined in the paper and discussion to the retort-house hands. The other kinds of labour, being of an intermittent and not a continuous character, do not appear to call for any special action—if, indeed, they admit of it, which is doubtful. The weak point of the paper and discussion is that, while the actual position of affairs was clearly brought out, the manager who reads the report with a view of getting assistance in the way of overcoming certain difficulties that are known to exist but which were hinted at rather than openly acknowledged, will find very little help. One may at once take it that public opinion is in favour of Sunday rest, and that no manager or foreman would oppose it. If the men are equally willing, the other difficulties soon disappear. And there is no reason why the position should not be discussed with a little more frankness than was evidenced at the Southampton meeting.

In the first place, it would seem that, according to the views and experiences of some, the Sunday stop is a source of profit and economy in working expenses, and that those who recognize no other God than the Almighty Dollar would therefore do well to adopt it on that account. Incidentally this may be the case; but it is lowering the tone of the position to introduce such an argument. In effect, it is the same thing as inviting a needy person to attend a place of worship for the sake of participating in the charities attached to the same. The only way in which such a desirable result can be attained is when the Sunday stop is so far appreciated by the men that it acts as an inducement to more careful or energetic labour, similar to the stimulus of personal interest afforded by the Livesey profit-sharing scheme. For the purpose of argument, we may take the case of twelve-hour shifts and a twelve-hour stop. The effect of introducing such an arrangement is that the working shifts are reduced 1-14th per week—viz., from fourteen to thirteen shifts. As much gas must be made in thirteen shifts as was formerly done in fourteen; and if the conditions of working continue the same, this means 7 to 8 per cent. more retorts under fire and seven to eight more men on the pay-sheet. In addition, there is the pay of the men who take charge during the hours of stopping, and other incidental expenses. If the same quantity of gas is made without more men or more retorts, it means that the make per man and per mouthpiece must be increased 7 or 8 per cent. This much must be done before any "profit" can be shown; and the increase must amount to 10 per cent. or so before any saving can be fairly credited to the Sunday stop. At some works, it would appear that this has been done. No other explanation is possible unless there were some adverse circumstances which the Sunday stop happened to circumvent. Some say that they get better results on the shift following the stop than at any other time, while others report the opposite. It is quite possible that the work may be done a little more smartly; but no one will pretend that the retorts have benefited by the twelve-hour stop—however much the men may have done so—and any marked improvement on the Sunday night seems to indicate that there is room for more rigid supervision over the retort-house work in a general way.

No doubt the reference to the discussion on the subject in 1870 and 1871 will lead many to look up their back numbers of the "Journal" or "Reports;" and all who, having no previous personal experience, are seeking for information that will enable them to minimize Sunday labour, will be well advised in reading the paper by Mr. Morton in 1870, and the discussion thereon, which led to the appointment of a Committee with instructions to investigate and report on the subject at the following meeting. A report, signed George Livesey, Chairman, was accordingly presented the next year; and it includes practical details for the carrying out of a twelve-hour stop. After showing that there is no practical difficulty as regards the working of the retorts and furnaces, the Committee go on to say: "As to pay, the system that regulates all ordinary manual labour should apply here—that is, the men should be paid only for the time they work. At the works mentioned, no pay is given for the Sunday to those men who do not work; and this has caused no discontent, the men being all of them thankful for the relief." This means, in effect, that the men were willing to lose one shift per fortnight. Before the stop, they went on regularly at seven shifts per week, and afterwards at seven and six alternately. Valuing the shifts at 5s. each, they changed from a regular 35s. to an average of 32s. 6d. —35s. one week and 30s. the next. Many of those who at present "do not see their way to adopt Sunday stops," would change their minds if they could be assured that the men under their charge would be equally reasonable. Reading between the lines of Mr. Shadbolt's report, it is easy to see that in many cases the men made it a condition in accepting Sunday stops that the weekly wage should not be reduced. This, assuming that no compensating circumstances can be introduced, means an increase of wages, and, to a great extent, of the wear and tear, to the extent of 7 per cent.

But this is not the only difficulty. There are several objectionable features about anything in the way of "Sunday pay," "holiday pay," or other pay over and above the time actually worked. Even if given as an act of grace at first, or on the understanding that the workmen should hold themselves in readiness for duty if required, it soon becomes regarded as a fixed emolument to be demanded as a right; and if Sunday labour is called for in case of emergency, there is a demand for time-and-a-half or other perquisites. This is the history of the Sunday labour movement in many small works. The men, having by some spurious argument secured the Sunday pay without the Sunday work, use it as a lever for further increase of emolument. It has been said that the excuse of shortage of storage or producing capacity does not apply for six months of the year, and that there is no reason why Sunday closing should not be introduced in the summer if it is not practicable in the winter. The real reason for holding aloof is that the manager does not know how far the concession in the summer may prejudice his position in the winter.

These are the real difficulties; and something in the way of promoting an appreciation of the Sabbath rest, and of the fact that, although a man may be entitled to it he is not also entitled to be paid for it, among the workers concerned, would be more efficacious in advancing the movement than any amount of enlargement of retorts and gasholders. As regards storage, increased day consumption has tended to reduce fluctuations of stock. In many gas-works the extreme variations of stock during the twenty-four hours do not exceed 25 or 30 per cent. of the output. There is some difference as regards the consumption on different days of the week, the consumption on Saturday being lighter in factory districts, and heavier in market towns, than on other days. The effect of stopping for twelve hours on Sunday is that the stock will be lower at 6 a.m. on Monday than at the corresponding period of the preceding day; and if, in addition to this, there is a heavy Saturday consumption to provide for—which means a further loss from Saturday to Sunday—the holder capacity must be equal to a safe working margin on Monday afternoon *plus* the loss experienced subsequent to the preceding Saturday at 6 a.m. The safe working margin is the lowest reserve that the manager feels to be sufficient without calling for anxiety as to whether the full pressure can be maintained, remembering that, for obvious reasons, he does not wish to practically ground his holders once a week. And the difference between the minimum as represented by the safe working margin, and the maximum as represented by the full storage capacity, affords room for meeting variations in the make or in the demand. These variations, expressed as a percentage of the daily or weekly output, are appreciably less than they were at the time when gas was chiefly required for lighting; and any works having a large factory consumption to meet during five days of the week, and depending upon Saturday and Sunday as a means of compensating for the losses of the other days, must occasionally run things close on Friday nights, and is generally not in a condition conducive to the best working results.

While the variations have decreased, the means of meeting them have advanced. The regenerator furnace, the inclined retort, and the water-gas plant all lend themselves to the purposes of the Sunday stop with greater facility than the old-fashioned grate furnace with comparatively few retorts over it. They are more elastic, admitting of a greater range of variation in producing power within the limits of the best working results, and can be got into full operation in less time than that represented in going the round of drawing and charging the whole of the retorts under fire in the usual way.

If the matter is approached in a reasonable spirit on both sides, and apart from the question of £ *s. d.* as shown by an expectation of better working results on the one hand, or of higher wages on the other, there is absolutely nothing in the way of a twelve-hour Sunday stop. The shareholders on their side must be prepared to allow, if necessary, a reasonable increase of expenditure; and the labourer, if he gets twelve hours rest, must not expect to get twelve hours' full working pay during that period. If the other parties concerned are agreeable, the manager will be willing to do his part. He has a certain share of the responsibility, but not all of it. There was a disposition to speak of the question as if the manager was the sole arbiter, without appeal. This is scarcely the real position. If the entire co-operation of the other parties concerned is not available, the manager cannot be expected to enter upon a contest in favour of the movement.

TECHNICAL RECORD.

MOVEMENTS OF THE FLAME IN THE EXPLOSION OF GASES.

At the Meeting of the Royal Society on the 5th ult., a paper on the above subject was read by Mr. HAROLD B. DIXON, M.A., F.R.S., Professor of Chemistry and Metallurgy in the Owens College, Manchester. We have received from the author, whose valuable researches on this and similar questions have been recorded from time to time in the "JOURNAL," an abstract of the paper, and have much pleasure in according it space.

I.—HISTORICAL INTRODUCTION.

Bunsen, in 1867, made the first careful measurement of the rate of which an explosion is propagated in gases; and he also made the first systematic researches on the pressure and temperature produced by the explosion of gases in closed vessels. His results led him to the remarkable conclusion that there was a discontinuous combustion in explosions. When electrolytic gas, or when carbonic oxide with half its volume of oxygen, is fired, only one-third of the mixture is burnt, according to Bunsen, raising the temperature of the whole to about 3000° C. No further chemical action then occurs until the gaseous mixture falls, by cooling, below 2500° C. Then a further combustion begins, and so on, *per saltum*. These deductions were criticized by Berthelot, who pointed out that they assumed the constancy of the specific heats of steam and of carbonic acid at high temperatures. Bunsen also stated that the rapidity with which the flame of the explosion spreads is synchronous with the attainment of complete combustion and of the maximum temperature.

In 1881, Berthelot and Le Chatelier independently discovered the great velocity with which the flame travels in gaseous explosions. Berthelot showed that this velocity was a constant for each gaseous mixture, and compared the rate of the "detonation-wave" (*l'onde explosive*) with the mean velocity of the molecules produced by the combustion before they had lost any heat. In the Bakerian Lecture for 1893, the author showed that Berthelot's theory did not account for many observed rates of explosion, and put forward the view that the explosion-wave travelled with the velocity of sound in the burning gases. Using the rates determined by the author, D. L. Chapman has argued that, if the explosion-wave is of a permanent type, an equation can be deduced from Riemann's formula by which the rates of explosion can be calculated if the specific heats are known, and *vice versâ*. The rate of the detonation-wave may therefore be utilized, according to Chapman, to determine the specific heats of gases at very high temperatures.

In 1883, Mallard and Le Chatelier published their researches on the combustion of gaseous mixtures. Using a delicate indicator, they found that rapidly exploding gases gave very high pressures for very small periods of time. These high but fugitive pressures they attribute to the compression-wave which is propagated as the inflammation spreads from layer to layer. To obtain the mean pressure of the ignited mass of gas, they had recourse to a less sensitive Bourdon gauge, and from the pressure curves so registered they calculated the maximum pressures and temperatures of the explosion. Their results may be summarized in the statement that the maximum temperature of the explosion of moist electrolytic gas is 3350° C, and the mean specific heat of steam between that temperature and 0° is 16·6 (at constant volume), dissociation being very slight, if any, between these temperatures. On the other hand, the mean specific heat of carbon dioxide rises to 13·6 at 2000° C, and above this dissociation begins. The simple diatomic gases (O_2,N_2,CO, &c.) show a rise of specific heat, though far less marked.

Berthelot and Vieille (1885) also determined the maximum pressures produced in the explosion of gases, and calculated the maximum temperatures. Their results were similar to those obtained by Bunsen; but they attribute the defect of pressure observed not to the inability of the gases to combine at the temperature reached, but to the great increase of the specific heats of the products of combustion.

On the other hand, Dugald Clerk contended (1886) that in an explosion the combustion is never completed instantaneously; and since the burnt gases are cooling while the unburnt are still combining, the observed pressures and temperatures fall short of those calculated for instantaneous combustion.

Mallard and Le Chatelier were the first to record the movements of the flame in explosions by photography on a moving film (1883). Failing to obtain images of the flame with mixtures such as $2CO + O_2$, they employed carbon disulphide (CS_2) with oxygen and with nitric oxide. When the gases were ignited by a flame at the open end of a long tube, the flame was propagated along the tube for some distance with a uniform slow velocity. In the case of mixtures of carbon disulphide with nitric oxide, this period of uniform movement is succeeded by oscillations of the flame, which sometimes become of larger and larger amplitude and then die down, and sometimes give rise to the "detonation-wave." When carbon disulphide is mixed with oxygen, the preliminary period of uniform movement is shorter, and is succeeded immediately by the detonation.

Mallard and Le Chatelier draw attention to the fact that in these explosions—starting at the end of a tube—the *development of the detonation-wave is not progressive, but always instantaneous.* When the mixture was fired near the closed end of a tube, the movement of the flame was uniformly accelerated until the detonation is set up. Their apparatus did not move fast enough to analyze the more rapid movement of the flame.

In 1888, Von Oettingen and Von Gernet analyzed the flame by means of a rotating mirror. Their photographs reveal, they state, the phenomena immediately succeeding the chemical combustion. For although the flame of electrolytic gas appeared intensely bright, its spectrum only gave the sodium and calcium lines, and the most sensitive photographic plates showed "hardly a trace of the process." Failing to photograph the flame itself, the authors added finely divided salts to the tube, and found that the most brilliant pictures were given by cuprous chloride. Their pictures show the passage of waves sharply reflected backwards and forwards from the ends of the tube, and gradually diminishing in intensity and velocity. These visible waves, according to Von Oettingen and Von Gernet, are not a picture of the process of combustion itself, but are compression-waves moving through the products of combustion after the explosion is completed. *The explosion itself*, they say, *is quite invisible.* Their photographs also show waves running nearly parallel with the primary waves. These secondary waves are particularly referred to as supplying conclusive evidence that *successive partial explosions* have taken place (starting from the electrodes) exactly as Bunsen imagined.

In 1884, Liveing and Dewar showed that the flame of an explosion in a glass tube exhibited the spectral lines of sodium and of calcium, and of iron when fired in an iron tube and examined end-on. When metallic salts were introduced in the form of powder, the corresponding lines were visible in the spectroscope. They made the interesting observation that the red lithium line was *reversed* when the explosion was made to travel towards the spectroscope, and they interpreted this to mean that the front of the advancing wave is cooler than the following part.

I have examined the spectra of many explosion flames. The light produced by the explosions of electrolytic gas is mainly due to particles knocked from the glass. In the faint continuous spectrum shown by the flame, the calcium lines stand out prominently. When the explosion travels first through a metal tube joined to a glass one in which the flame is photographed, the light is more intense near the junction. One can see the stream of luminous matter carried out of the metal tube. The cyanogen explosions, however, give a continuous spectrum crossed by metallic lines and by the characteristic "cyanogen lines." The luminous particles, whatever their nature, follow very closely the movements of the gas in which they float. When the spectra of the explosion flames were photographed end-on, I have never observed any reversal of a line in the advancing flame.

II.—PHOTOGRAPHIC ANALYSIS OF DETONATION-WAVES AND THEIR REFLECTIONS.

[In conjunction with E. H. STRANGE, B.Sc., and E. GRAHAM, B.Sc.]

By throwing the image of the explosion-tube on to a photographic film (Eastman's) fixed to a rapidly revolving wheel, we found that the flame could be sharply photographed, and its movements analyzed, without the addition of any metallic salts to the tube.

The first point noticed in the photographs were (1) the sharpness with which the luminosity is set up; and (2) the uniformity of the detonation-wave. There is no evidence of any gradual heating up of the gases, but, on the contrary, the temperature appears to spring to its maximum with abrupt suddenness. The gas ignited by the detonation (including particles knocked off the tubes) remains luminous for some time after the wave has passed. Many of the photographs show very distinctly the movements of the gas *en masse*, as it follows up the detonation-wave, comes to rest, and swings back again.

When the detonation-wave hits the closed end of the tube, it is reflected back in a distinctly marked luminous wave, remarkable for its great luminosity. As this reflected wave starts back from the closed end, it has at first to meet the gas moving bodily forward in the wake of the detonation-wave. As it continues backwards, the gas it meets has less forward motion, then becomes stationary, and finally travels back in the same direction as the reflected wave. It follows, therefore, that the velocity of the reflected wave is at first retarded and afterwards increased by the motion of the medium.

The reflected wave produced by the collision of a detonation-wave with the closed end of the tube is mainly an intense compression-wave. The velocity of the reflection-wave may be readily compared with that of the detonation-wave. In the following table, the average velocities observed in several gaseous mixtures are given, the velocity of the reflected wave being taken as nearly as possible at the point where the movement of the gas itself was *nil*.

TABLE I.—*Velocity of Reflection-Waves in Gaseous Explosions.*

Mixture of Gases.	Velocity of Explosion-Wave in Metres per Second.	Velocity of Reflection-Wave in Metres per Second.	Ratio of Velocities.
$2H_2 + O_2$	2820	1538	1·83
$H_2 + N_2O$	2305	1383	1·67
$2CO + O_2$	1676	1078	1·56
$C_2N_2 + O_2$	2728	1230	2·22
$C_2N_2 + 2O_2$	2321	1129	2·06
$2C_2H_2 + 5O_2$	2391	1133	2·11

Although the formula for the velocity of sound in gases is strictly valid for small displacements only, nevertheless it appeared of interest to calculate from the observed velocities of these reflection-waves what temperature they indicated in the gas, on the assumption that they were propagated as sound-waves. Of course, to calculate the temperature from the velocity of sound, it is necessary to know the ratio of the specific heats γ; and since in the case of carbonic acid and steam this ratio is very doubtful, a corresponding uncertainty must exist in the temperature calculated. But in the case of cyanogen burning to carbonic oxide, the products of combustion, carbonic oxide, and nitrogen are similar to air, and their specific heats either do not alter, or do not alter greatly, with rise of temperature. The velocity of sound in such a gas would therefore give an approximation to the temperature.

Now the velocity of the reflection-wave in cyanogen exploded with its own volume of oxygen is 1230 metres per second. Assuming γ to be unaltered by rise of temperature, and the velocity of sound in air at 0° C. to be 333 metres per second, the temperature of the gas where the reflection-wave was measured is given by the formula—

$$T = \left\{ \left(\frac{V \sqrt{\frac{d_1}{d}}}{333} \right)^2 - 1 \right\} 273 = 3330° \text{ C.}$$

where V is the velocity of sound, and d_1 and d the densities of the gas and air respectively under the same conditions. If, on the other hand, we assume (with Le Chatelier) that the specific heat at constant volume of diatomic gases rises with the temperature and becomes 7 at the temperature of this experiment, then the ratio γ_1 falls to 1·29, and the formula becomes—

$$T = \left\{ \left(\frac{V \sqrt{\frac{d_1}{d} \frac{\gamma}{\gamma_1}}}{333} \right)^2 - 1 \right\} 273 = 3672° \text{ C.}$$

In the case of cyanogen exploded with twice its volume of oxygen, the first reaction probably consists in the burning of the cyanogen to carbonic oxide, which combines more slowly to form carbonic acid. How far this second reaction is completed when the reflection wave is measured, it is impossible to decide. On the assumption that the specific heat of nitrogen is constant, and that CO_2 is 7·2, the velocity of the wave in the completely burnt mixture indicates a temperature of 4200° C. On the assumption that the specific heat of CO_2 and N_2 are 20 and 7, the temperature indicated is 4780°C. On the other hand, if no CO_2 had yet been formed, the temperature indicated for the mixture of diatomic gases ($2CO$, O_2, N_2) is 2880° C (C_V=4·8).

In a similar manner, the temperatures corresponding to the velocity of the reflection-waves have been calculated for the other mixtures, (1) assuming the ratio of the specific heats for a diatomic gas to be 1·41, and for a triatomic gas 1·28; and (2) assuming the ratio of the specific heats for a diatomic gas to be 1·29, and for a triatomic gas 1·11 :—

TABLE II.—*Temperatures of Exploded Gases Calculated from the Velocities of the Reflection-Waves.*

Mixture.	I. γ for Diatomic Gas = 1·41. γ for Triatomic Gas = 1·28.	II. γ for Diatomic Gas = 1·29. γ for Triatomic Gas = 1·11.
	Deg. C.	Deg. C.
$2H_2 + O_2$	3720	4830
$H_2 + N_2O$	3660	4130
$2CO + O_2$	4530	5250
$C_2N_2 + O_2$	3330	3670
$C_2N_2 + 2O_2$	4200	4780
$2C_2H_2 + 5O_2$	3980	4630

A glance at this table reveals the fact that, whether the specific heats vary or not, but on the assumption that combustion is complete in each case, the explosion of cyanogen to carbonic oxide, which, according to all observers, gives the brightest flash and the highest pressure, also gives (apparently) the coolest combustion products a short time after the explosion-wave has gone by. The natural inference to be drawn from these figures is that in those mixtures where steam or carbonic acid, or both, are produced, the combustion is not complete at the moment the reflection-wave is measured.

III.—On the Velocity of a Sound-Wave in the Flame of Exploded Gases.

[In conjunction with R. H. JONES, B.Sc., and J. BOWER, B.Sc.]

The interest attaching to the determination (even approximately) of the temperatures produced in the explosion of gases led us to attempt the measurement of the rate of a true sound-wave (of small displacement) in the gases produced by the detonation-wave.

In our first experiments, the glass explosion-tube was fitted to a steel piece containing a tap of large bore and a small bye-tap, and connected by a pipe to a steel bomb, in which a small charge of fulminate could be fired. The bomb and connecting-pipe were filled with air, while the tube was filled with a mixture of cyanogen with two volumes of oxygen. The lengths of the tubes were so adjusted that the sound wave, started in the bomb by the detonation of the fulminate, should be propagated through the air and cyanogen mixture, so as to meet the detonation-wave coming in the contrary direction before the latter reached the end of the tube. The detonation-wave was then photographed as it met the sound-wave. The photographs clearly show several sound-waves passing through the incandescent gases. The rates of these sound-waves have been measured, and the corresponding temperatures calculated. These values are given in Table III. on the assumption that the combustion was complete :—

TABLE III.

Number.	Velocity of Sound-Waves in Explosion of $C_2N_2 + 2O_2$.	Calculated Temperature. γ for Diatomic Gas, 1·41. γ for Triatomic Gas, 1·28.
		Deg. C.
1st	1116 metres per second.	4100
2nd	1014 ,,	3330
3rd	893 ,,	2530

It will be seen that the temperature calculated for the first sound-wave (4100° C.) is in close accordance with that calculated from the reflection-wave in the same mixture (4200° C.) given in Table II.

The experiment was next varied by the introduction of a thin iron membrane between the air and the explosive mixture. The shock transmitted through the air from the fulminate struck the flexible plate, and so propagated a wave of small displacement through the explosive mixture. This wave had very little effect on the movements of the gas in the wake of the detonation-wave; but its passage through the luminous gas was plainly marked. The gases were ignited as before, the lengths of the tubes being so adjusted that the first sound-wave met the detonation-wave about 1 metre from the membrane.

With the mixture $C_2N_2 + O_2$ three photographs were obtained in which the course of the sound-waves were fairly marked. The mean of several independent measurements made on each photograph gave as the velocity of the sound-wave *in the stationary gas* as 1250 metres per second. This velocity corresponds to a temperature of 3460° ($\gamma = 1·41$), a number in very fair agreement with that calculated from the reflection-waves—viz., 3330° C. (Table II.). This agreement indicates that the reflection-waves really travel with a velocity approximately equal to that of sound.

IV.—On the Collision of Two Detonation-Waves, and the Effect of Junctions in the Tubes.

[In conjunction with R. H. JONES and J. BOWER.]

To study the effect produced in the collision of two waves of detonation, the explosion-tube (of lead pipe) was bifurcated into two arms of equal length, which were bent round and held the two ends of a strong glass tube, in the centre of which the two waves met. The joint between the lead and glass was made tight with india-rubber. The photographs obtained with this apparatus were puzzling. Some of the "rebound waves" after the collision were much brighter, and travelled (backwards) much faster than the detonation-waves themselves. Moreover, many photographs showed that the flame of the explosion had been affected by some impulses causing a sudden increase in its brightness and velocity, and producing a backward wave (analogous to a reflected wave).

The explanation of these appearances that first occurred to us was that the flame was preceded by invisible sound-waves, travelling more quickly than the flame in its initial phases; that these sound-waves became visible as soon as they met the flame moving towards them in the opposite direction (as in our previous experiments on sound-waves); and that, on the other hand, the visible flame meeting the sound-wave was affected by the sudden increase of pressure, and continued its journey with greater speed and luminosity. This explanation was at once destroyed when we found similar impulses in a flame which was sent through the apparatus in one direction only.

It next occurred to us that these impulses might be due to the explosion *catching up its own sound-waves*. If sound-waves are propagated through the gas from the point of ignition, the flame

might lag behind the sound-waves at first and catch them after a run more or less prolonged. The sound-waves when overtaken might cause reflected sound-waves (made visible in the luminous gases), and the explosion itself might become more intense owing to the collision. Many experiments were undertaken to verify or disprove this hypothesis; but finally it was found that the explosion was affected as it passed through the junctions between the lead and the glass, and the "impulses" recorded in our photographs were due to the detonation-wave, damped down at the junction, being regenerated by fits and starts.

The flame is not retarded by turning round a corner, even when that is a sharp angle, nor is it damped down when the connecting junction is made of stout flexible rubber. After many trials, we found that the only thing which mattered was the rigidity with which the glass and metal were connected together. Any packing (such as rubber) which gave to a shock caused a retardation; when the glass was firmly cemented to the metal, no retardation occurred. The anomalies met with in our collision experiments were thus accounted for, and the examination of collisions between true detonation-waves was proceeded with. When two detonation-waves come into collision, the tube remains brightly luminous at the point of contact for some time, and two reflected waves are sent backwards with velocities which increase at first, owing to the movement of the gas through which they are propagated.

A comparison of all the photographs shows that the gases are more luminous after a collision than when the explosion-wave strikes a flat surface of metal fastened at the end of the tube. The reflected waves in the two cases are similar in character, but the reflection generated by collision with another detonation-wave seems always to travel slightly faster. If we were dealing only with waves produced mechanically, the reflected waves would be exact copies of the incident waves with velocities reversed—in both cases. But in the detonation-wave, we have chemical as well as mechanical action, while the reflected wave is mainly mechanical. We should expect, therefore, the reflected waves to travel more slowly than the incident waves; but we should also expect the reflected waves to travel with the same velocity whether they were produced by collision with a rigid diaphragm or with a similar and equal wave travelling in the opposite direction—*unless there was some chemical difference involved in the two kinds of collision.*

Our photographs have shown that the wave of detonation has certain characteristics by which it may readily be recognized: (1) It starts suddenly, throwing back a strongly luminous wave through the burning gases, and leaving a dark space where it started. (2) It travels with constant velocity, unless it traverses a junction not rigidly attached. After being damped down by such an obstacle, it recoups itself and again starts with abruptness. (3) On collision with a similar detonation-wave moving in the opposite direction, or with a rigid diaphragm, it sends back a reflected wave not so rapid as itself, and as a rule not so luminous.

In the case of the more luminous explosions—*e.g.*, those of cyanogen, acetylene, and carbon disulphide mixtures—the reflected waves were less luminous than the detonation-wave. But in the case of the less luminous explosions—*e.g.*, those of hydrogen and carbonic oxide—which depend largely for their light on the particles detached from the tubes, the waves reflected from a collision were sometimes more luminous than the detonation-waves themselves.

V.—On the Initiation of the Detonation-Wave and on the Wave of Retonation.

[In conjunction with R. H. Jones and J. Bower.]

Our photographs show abrupt changes in the acceleration of the explosion before the final spring which marks the detonation-wave. These sudden changes are accompanied by a luminous wave thrown back through the ignited gases.

The strongly luminous wave thrown back from the point where the detonation is started we call the "retonation-wave." A study of a number of photographs leads to the conclusion that the retonation is faster and more luminous when no other bright waves have been thrown back by the advancing flame before the point of detonation is reached.

The collision of two flames in which detonation had not yet been determined gave rise to reflected waves more rapid and more luminous than the incident waves. Now these reflected waves could not owe their increased velocity to the mechanical impact, which could only result in the reflected waves being copies of the incident waves. It is evident then that chemical action must occur to assist these reflected waves, and, therefore, the combustion is obviously not complete when these waves return. From this it would appear probable the period before the detonation is distinguished not only by a slower propagation of the flame—*i.e.*, of ignition—but also by a slower process of combustion.

At the point of detonation, the rapid rise of pressure produces not only the forward wave—that of detonation—but also a backward wave of compression into the gases still slowly burning behind it. This compression-wave must raise the temperature of the ignited gases and quicken the residual burning; its propagation would thus be analogous to that of the detonation-wave, but modified by the extent to which the slow combustion had proceeded.

The retonation-wave attains its greatest rapidity and brightness when it is developed at the closed end of a tube—*i.e.*, when the gas is fired at such a distance from the closed end that the explosion, gradually increasing in intensity, just reaches the detonation-point as it arrives at the stopper. Under such conditions, the reflected wave is superposed on the wave of retonation, and the result is a wave which cannot be distinguished from a detonation-wave.

As regards the dark space formed at the point where the detonation and retonation-waves originate, it is no doubt a space of cooler gas. It persists for some time, and its damping effect on the passage of collision-waves can be observed in several of the photographs.

VI.—On the Initial Phases of the Explosion.

[In conjunction with R. H. Jones and J. Bower.]

As several of our photographs had shown that the flame in the period of acceleration was overtaken by a more rapidly moving wave, we photographed the *beginning* of an explosion of cyanogen with oxygen, and found that the bright flame which overtook the primary flame came *from the end of the tube near the firing wires.* The "kick-off" which the explosion gets from the closed end apparently enables the reflected wave to overtake the original wave of combustion. When the gases are fired by means of wires just penetrating the stopper closing the end of the tube, the explosion proceeds more slowly, and without disturbance by any sudden changes of acceleration until at last the point of detonation is reached. The photographs of these explosions are in marked contrast to those taken when the firing wires were 3 inches from the end of the tube. In the less rapid explosions, it is seen that the flame does not travel direct to the near end of the tube, but while still a short distance from it recedes and again approaches with an oscillatory motion, which is repeated before the flame finally reaches the end of the tube. From the point where the flame is first checked, a luminous wave is seen running back and overtaking the main flame, which at this point acquires greater brightness and velocity. From the point of collision where the faster overtakes the slower flame, a reflection is thrown back to the near end of the tube, where it is again reflected.

Now, when an explosive mixture is fired by a spark, the suddenly ignited gases must expand and transmit a compression-wave in both directions. This travels with the velocity of sound in the unburnt gas, and will be reflected from the end of the tube. The propagation of the flame from the firing-point is, in most gaseous mixtures, less rapid than the velocity of sound in the unburnt gas; but the rate of propagation of the flame augments much more rapidly in some mixtures than in others. If the tube is a long one, the flame will overtake the sound-wave after a more or less prolonged chase, according to the nature of the mixture. But if the tube is short, the sound-wave may reach the end of the tube and return as a reflected wave to *meet* the flame, which is still advancing. Our measurement show this to be the origin of the "return-wave" from the end of the tube.

When gases are fired in the centre of a long tube, the phenomena of explosion are simple; when they are fired in the centre of a short tube, the sound-waves generated reach the end of the tube before the flames, and the impact of their reflections with the flames produces cross-waves of great intricacy and beauty.

VII.—Further Experiments on Initial Phases.

[In conjunction with B. Dawson, B.Sc., and L. Bradshaw, B.Sc.]

1.—*Le Chatelier's Hypothesis of Discontinuity in the Explosion.*

Many photographs show a peculiarity at the point where a less luminous line is succeeded abruptly by a more luminous one. The lines photographed do not appear continous, but the more luminous line appears to start from a point not yet reached by the less luminous one. The point of collision also of two waves appears to project in front of the waves which are meeting. It seemed to me at first as if these appearances might be due to invisible waves advancing in front of the visible ones; but as I found that they only showed where the luminosity of the lines was in marked contrast, and disappeared entirely when the films were not sensitive, or the contrast of luminosity was diminished, I came to the conclusion that the effect was due to halation on the photograph—the brighter lines being enlarged. But in 1890, Le Chatelier, relying on the same kind of evidence, put forward the view that the wave of detonation starts in front of the variable wave (which is increasing in velocity), and originates in an invisible wave which is proceeding in front of the visible wave, and with a velocity equal to it.

This definite judgment of the French experimenter compelled us to re-examine the question. We attempted at first to decide the matter by photographing an explosion as it passed from a less luminous mixture into a more luminous one; but we could not succeed in making the transition sufficiently sudden. We did, however, succeed in obtaining sudden changes of brightness by introducing a layer of Welsbach salts (a mixture of thoria and ceria), and having the rest of the tube quite clean. Although to raise the salt from the glass and to render it incandescent must take some time, nevertheless the photograph shows a small but

distinct break in the line of detonation similar to that in question.

It is, of course, easy to show the enlargement due to brightness. If a tube is filled with a mixture giving a luminous explosion, and the explosion is photographed while half the tube is covered over, and if the tube is then filled with a mixture giving a less luminous explosion, which is photographed on the same film while the first half of the tube is covered, a photograph is obtained which shows a greater discontinuity than any of those in question.

Another way of showing the same thing is to photograph a thin platinum wire stretched by weights, and rendered luminous by an electric current. If a second wire is brought to touch the first so as to divide the current, the portion of the wire which carries the whole current is more luminous than the other portion, and the photographs make it appear of far greater diameter.

The evidence against Le Chatelier's view may thus be summarized: (1) Its supposed effect is only seen when the contrasts are strong, and not on photographs of the same phenomena in which the contrasts are not brought out. (2) It can be initiated in various ways by means of contrasts. (3) The same effect is seen in the collision of two detonation-waves; but Le Chatelier does not suppose that the "invisible wave" can precede the detonation.

2.—Repetition of Von Oettingen and Von Gernet's Experiments.

The very short time required for the explosion in electrolytic gas to raise the Welsbach oxides to incandescence was strong evidence against the view held by Von Oettingen and Von Gernet—viz., that the detonation of electrolytic gas is invisible, and that the salts present in their experiments only became luminous after the combustion had been for some time complete. Our previous experiments had also shown conclusively that the detonation is not set up at once, but only after the flame has run some distance, which varies with the nature of the mixture and the position of the spark. But, to place the matter beyond all doubt, we have repeated their experiments, using a tube of the same size and construction as theirs filled with electrolytic gas, but without the addition of any salts. By careful development, the course of the flame can be seen on the negatives from the firing wire. In all cases the explosion begins slowly, and has slight luminosity until the retonation-waves are started by reflection from the ends of the tube. Some of our photographs closely resemble in detail those published by Von Oettingen and Von Gernet; but they show the initial movements of the flame, which are lacking in their photographs. The reflections of the two waves often run nearly parallel, but the stronger wave usually catches the weaker and coalesces with it. The photographs thus make clear how "secondary" waves running parallel with "primary" waves may be produced from a single explosion in a short tube.

WESTERN (U.S.A.) GAS ASSOCIATION.

We have already noticed several items of the recent meeting of this Association,* and now add a few more particulars.

Presidential Address.

The President, Mr. Thos. D. Miller, of Dallas (Texas), in his Inaugural Address, alluded to the fact that the Association was now twenty-five years old, and dwelt at some length on the work already achieved by it, and the prospects for the future. According to official returns, 30 per cent. of the gas plants in the United States were operated in connection with electric plants. During the ten years ended 1900, the value of the products from gas plants had increased 33 per cent., the sales of gas 84 per cent., and the invested capital 119 per cent. The average investment per establishment had nearly doubled, although half the undertakings represented districts of less than 10,000 inhabitants, and many less than 5000. While the manufacturing costs had been reduced by improved methods and processes, the distributing costs had, if anything, increased. There was a smaller consumption per consumer, and more attention to the requirements of the public. He thought no other industry could instance such sweeping reductions in selling price. In 1850, the returns only included 30 undertakings, but those of 1900 included 877. During the fifty years, the income had risen from about £400,000 to about £19,000,000 sterling, and the working expenditure from £225,000 to over £10,000,000. The average price of gas in 1900 was 4s. 2d. Referring to the general complaint as to poor quality of coal, he said the explanation was due to the fact that the miners were now paid on the quantity raised, regardless of quality; whereas formerly they were only paid for screened coal, and this removed all inducement for care in cutting and loading. The development of the Beaumont oil-fields, like those of Ohio and Indiana, would encourage the use of water gas. It was now a demonstrated fact that all natural gas supplies failed in time, so there was no occasion for particular alarm in the proximity of a natural gas supply. It would for a time take away some custom; but it introduced people to the conveniences of gas, and when it failed they would not go back to solid fuel. Referring to electricity, he said that a great deal had been claimed for the Nernst lamp; but he did not think it would prove a stronger competitor than arc lamps. Gas afforded an equally convenient and much cheaper illuminant; and he looked for an advance in its use for this purpose. Some other Associations were adopting a plan which promised an improvement on the usual procedure of inviting papers, and that was the assignment of specific subjects to members selected by the Committee. In some cases two or more members were asked to deal with the same subject; and he strongly recommended this to the meeting.

In the course of the general business, the report of the Library Committee was presented by Mr. F. H. Shelton, who acknowledged several donations of books, and urged the members to assist the good work. The issue of the card index had been delayed through unavoidable causes, but was now in hand, and the first batch would be forthcoming in the course of the summer.

Experiences with Bench Fuels.

The first paper taken was by Mr. W. A. Baehr, of Denver (Colorado), and dealt with the above subject. The author had carried out a series of experiments with lignites and semi-bituminous coals, which appeared to offer some advantage in regard to price as compared with coke. The gases were analyzed for carbonic acid, oxygen, and carbonic oxide by uniform processes, using Orsat's apparatus and Cooper's tubes. The temperatures were taken by a Schaffer and Budenberg thermometer inserted in the chimney about 5 feet above the tops of the benches; the calorific value tested with a Carpenter's calorimeter, and computed values based on Dulong's formula. The bench used for the experiment was a full-depth regenerator, containing six retorts 15 in. by 26 in. by 9 ft. long, four-hour charges, coal per retort per twenty-four hours 2000 lbs., and drawing and charging done by hand. Arrangements were made for accurately weighing the coal and coke used. He tried hot coke, cold coke, Sopris gas coal, and two kinds of peat lignite; and he exhibited tables giving full particulars of proximate and ultimate analysis, calorific power, weight of fuel used, weight of coal carbonized, analysis of flue gas, and comparative cost. With coke, the bench would run nicely without trouble. The coals and lignites, however, if used alone, caked badly and needed frequent stirring in the furnace, and also deposited soot in the flues. It was found, too, that if the lignites were introduced in large quantities, the volatile matters came off so rapidly as to make a flame several feet high above the top of the chimney, which meant a serious loss of heat. This necessitated light feeding at frequent intervals, and increased the cost of labour. A mechanical device, such as a screw feed, could probably be used with advantage. After prolonged trial, it was found impracticable to use coal or lignite alone. Air could not be supplied evenly, and unburnt fuel came down to the clinker; so he next tried mixtures with coke, using 40 to 50 per cent. Comparing hot with cold coke, he calculated that the loss of heat with cold coke was 1,309,000 B.T.U. per twenty-four hours. As the results of analyses of the flue gases, he was able to introduce considerable economy of fuel. He considered any gas engineer would find it worth while to adjust the dampers by analyses rather than by rule-of-thumb. He also tried some experiments with an American 6-inch underfeed mechanical screw stoker, with a No. 1 Sturtevant monogram blower belted to a 2-horse power electric motor, and a pipe 6 inches diameter for the primary air supply, which was delivered below the furnace. The fire being started with hot coke, they used pea coke for a blast pressure of about 0·9 inch, but were unable to get up anything beyond a dark red heat in the setting. They then increased the blast to 12-10ths, and also endeavoured to maintain a fuel bed at least 24 inches thick. This showed some improvement, and encouraged them to gradually raise the blast to 32-10ths. This, however, was rather too much, and they finally settled down to about 27-10ths. With this arrangement, they tried mixtures of lignites with the coke, and finally lignites alone. One disadvantage was that they failed to get anything like a complete reduction of the carbonic acid in the furnace gases with this arrangement. With lower blower speeds, less fuel was used; but they could not keep up a proper working heat. They next tried the mechanical stoker with pea coke as a free-fired grate, with the primary and secondary air inlets stopped and the ash-pan open. But this was a failure, as they could not get a good heat. A second experiment, with the grate raised so as to be nearer the retorts, shared the same fate. In the boilers he used Simpson lignite having an evaporative value of 6 lbs. of water per pound. The result of his experiments showed that, with a fair market for coke, there was some slight saving in using mixtures of lignite and coke, and that it paid to use gas coal as fuel.

Discussion being invited, Mr. Cowdery said that, as a general proposition, it might be assumed that if engineers preferred to use coal, they could keep up the heats with about the same weight as the coke required. But he thought that the mechanical stoker would be required when coal was used. An economical fuel might be prepared by mixing two to three parts of small coke with one part of coal. Mr. Steinwedel thought that the

* See "Journal," Vol. LXXIX., pp. 1558-60.

difficulties mentioned by the author as attendant on the use of coal could be overcome by structural alterations, such as a wider furnace and larger area of flues. He thought the usual plan of introducing the fuel at the front was preferable to the underfeed described by the author. To get good results with the mechanical stoker, the furnace would have to be very long and the gases must travel to the rear and then back to the front. Mr. Norris had used up all the pan breeze in one of his furnaces with the aid of a Parsons steam-jet blower, getting as good heats as with an ordinary coke fuel.

Beaumont Oil for Gas Making.

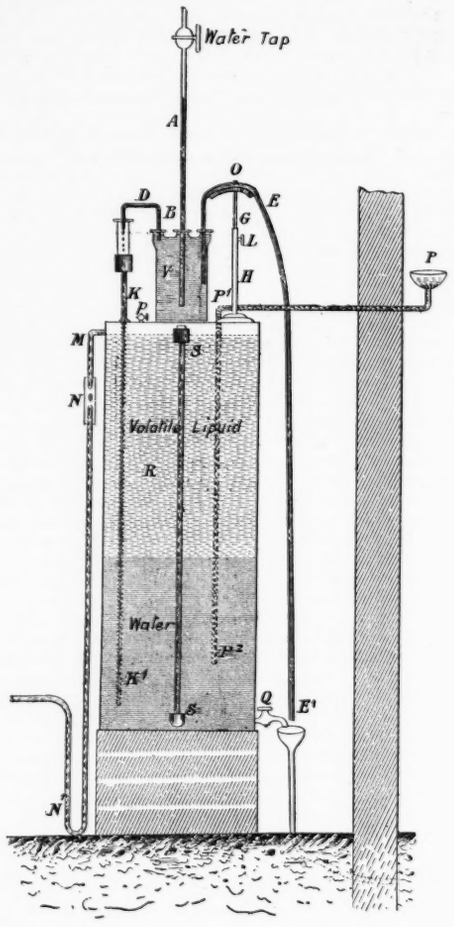
There was a full discussion on the above paper, an abstract of which has already appeared in the "Journal."* The President remarked that although the Texas oil-field had not been opened much over a year, it had exerted an influence on the oil market; and he appealed to the members to bring out all the figures, facts and information about it they could. Mr. Doty understood that the oil was fairly satisfactory, but the high percentage of sulphur in it required additional purifying capacity. Mr. Marshall said the oil was almost equal in value to that from Pennsylvania, but the purifying was a difficulty. Mr. Cowdery said the oil was giving satisfaction at Chicago. He understood somewhat higher heats were required to work it. He would like to ask if it was sent out fresh or stored for a sufficient time to allow sediment, water, &c., to settle out. Mr. Shelton said that at Staten Island (N.Y.) they had taken up the use of Texas oil in ease and comfort; and it had lately been introduced at New Orleans. The heats required a little careful attention; the purifiers came off twice as often; and the efficiency was 85 to 90 per cent. as compared with other oils. In many districts it would be cheaper than other oils, and a great help to the gas business. Mr. Jenkins had tried Beaumont oil at San Antonio. At first he ran the heats too high, and choked the carburettors with coke. Having adjusted this matter, there was no further difficulty beyond the purifiers coming off more frequently. He had made some experiments on a small scale, and found that the residual tar or pitch was 6 oz. per gallon; and this residue yielded about 60 per cent. of coke. The calorific value of the gas was 1142 B.T.U. per cubic foot. The average of several experiments gave 0·8 per cent. of sulphuretted hydrogen and 7·95 per cent. of carbonic oxide [? carbonic *acid*] in the crude gas. The average calorific value of the carburetted water gas made with the oil and supplied to the district was 630 B.T.U. per cubic foot. At St. Louis the experience had been about the same. There was some difficulty at first; but this had been remedied, and the oil was now giving satisfaction. The calorific value of the gas ranged from 600 to 760 B.T.U. per cubic foot, according to the proportion of oil used. To make 19-candle gas, nearly 5 gallons of the oil per 1000 cubic feet were required. Mr. Norris said that, as compared with other oils, the Texas oil required more careful regulation of the heats. It had a different base from the paraffin oils of Ohio and Pennsylvania, and broke up differently; and with excess of heat it gave an unusual amount of lamp black and naphthalene. The illuminants in the gas contained a large proportion of the benzene series of hydrocarbons. They were about 75 per cent. as compared with the other oils, and less permanent at low temperatures. Ordinary gas oil contained 2-10ths of a per cent. of sulphur, Ohio crude 4-10ths, and Beaumont crude 1¾ per cent. The crude gas from the first named contained 125 to 175 grains of sulphuretted hydrogen per cubic foot, but that from Texas oil 350 grains. This was not a serious quantity, as gas from West Virginia coal frequently approached 1000 grains per cubic foot. But Texas oils also gave a considerable quantity of sulphur other than sulphuretted hydrogen, which was not removed by oxide purification. He would like to know if the Texas oils had been successfully treated for the reduction of sulphur. Mr. Berkley had tried the Texas oil and found he could not get quite such a good yield per hour; also that he must use rather more of it to keep up the candle power. Mr. Collins recorded a similar experience.

(To be continued.)

PREVENTION OF NAPHTHALENE DEPOSITS.

This subject was dealt with in a paper read by M. Roillé at the last meeting of the Société Technique du Gaz en France. The author had for a long time been troubled with deposits of naphthalene; and all his efforts to cure the evil had been unsuccessful on account of the difficulty he experienced in passing into the mains a regulated quantity of dissolving liquid in proportion to the bulk of gas made. He therefore decided to use gasine, or light petroleum spirit, and to cause it to flow by displacing it by water. In order to accomplish this object, he employed a Woulfe bottle, which did duty for a Mariotte vessel, with the advantage of dispensing with taps, and allowing the flow of water to be varied to any desired extent. This was really all that was new in the idea.

The apparatus, which is shown in the accompanying illustration, consists of two parts—the reservoir, containing the gasine, and the apparatus supplying the necessary quantity of water. The former is 12 inches in diameter; and as 20 drops of water are 1 cubic centimetre in bulk, one drop per minute for 24 hours represents a height of liquid of about 1 millimetre (0·04 inch) in the cylinder. Now, supposing the make to be 3000 cubic metres (106,000 cubic feet) per day, and it is desired to convey 2 grammes of liquid per cubic metre (35·3 cubic feet) per 24 hours, it would be necessary to put in 83 drops per minute, which would be equal to a height of about 3⅓ inches in the cylinder.



The gasine is introduced by the pipe P'P'' connected with the receptacle P, which, as shown, is placed outside the building containing the apparatus, so that any of the spirit being spilt no accident need be feared. As the gasine is displaced by the water, it flows by the pipe M N N', which is so arranged as to allow of the drops being counted. This pipe is bent at N', in order to prevent gas from making its way into the reservoir. A glass tube S S' passing through the vessel, enables the quantity of volatile liquid in the apparatus to be ascertained; and when it is seen that more is required to be introduced, water is drawn off by the tap Q—care being taken at the same time to open the small cock *q* to allow air to enter. The water is conducted to the bottom of he vessel by the pipe K K'. The admission of water in proportion to the make of gas is regulated by means of a flask V, with three tubulures. The water enters by the pipe A, and a portion leaves by a second pipe B, fitted with an india-rubber tube B E E'; a smaller tube D, starting from the third tubulure, ending in a drop-counter. A support in two parts G H, furnished with a set-screw L, allows the level to be regulated by raising the india-rubber tube, in which there is a hole O to prevent the pipe from priming, and emptying the flask. It will be seen that by raising the tube the pressure at the extremity of the drop-counter will be increased, and a greater flow secured; and by careful manipulation the exact number of drops required will be obtained. The apparatus may be usefully employed whenever it is desired to ensure a regular flow of the liquid; and when once the proper level has been adjusted, any excess liquid can be easily recovered.

The Sleaford District Council have been considering the subject of driving the engine at the sewage works, and have decided upon employing electricity as the motive power, though certainly not on the score of economy, if we may take as correct the figures submitted at the last meeting of the Council. It appears that the cost of the cable and an engine driven by electricity will be £267 11s. 2d., with the current at 3½d. per unit, while a gas-engine would cost only £170 4s. 6d., with gas at 1d. per hour.

* See Vol. LXXIX., p. 1559.

A NEW COKE-CONVEYOR AT THE CASSEL GAS-WORKS.

The following is an abstract translation of a description in the "Journal für Gasbeleuchtung" by Herr E. Merz, the Manager of the Cassel Gas-Works, of a recent installation of a modified De Brouwer conveyor there.

In the building of gas-works eight or ten years ago, it was only rarely that any arrangements were made for the mechanical conveyance of coal and coke; but recently a complete change has taken place in this respect. The employment of manual labour for moving the large quantities of these materials is attended with many disadvantages. To remove the red-hot coke as quickly as possible out of the way of the workmen employed at the retorts, and at the same time to quench it automatically, is the two-fold object aimed at in a coke-conveyor. This has of late been accomplished by fixing an iron trough on the discharging side of the retort-settings, in which the coke coming from the retorts is caught up and carried away by a chain. A special contrivance automatically quenches the coke during its passage along the trough. On the Continent, the De Brouwer conveyor has been introduced at a number of the larger gas-works. In 1898, one of these conveying troughs was fixed at the works at Cassel, for the purpose of transporting the coke from the third bench of retorts, consisting of five settings of nines, to the coke-shed. This trough worked for 688 days; and during that time the following defects were observed.

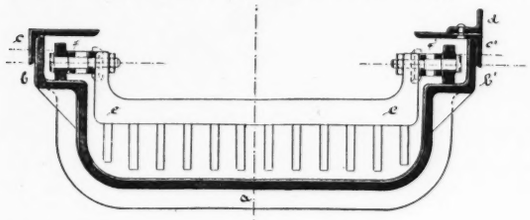


FIG. 1.

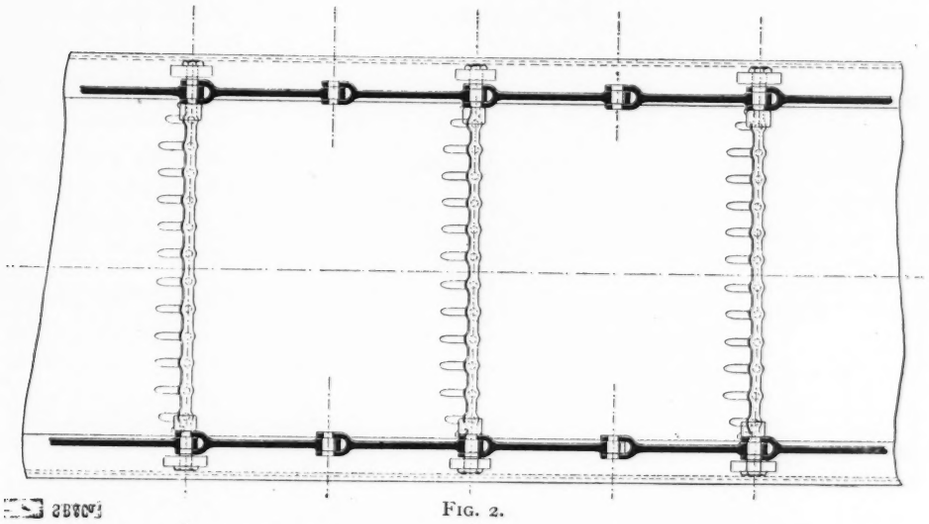


FIG. 2.

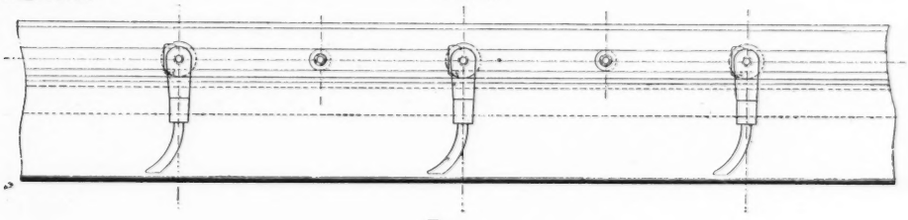


FIG. 3

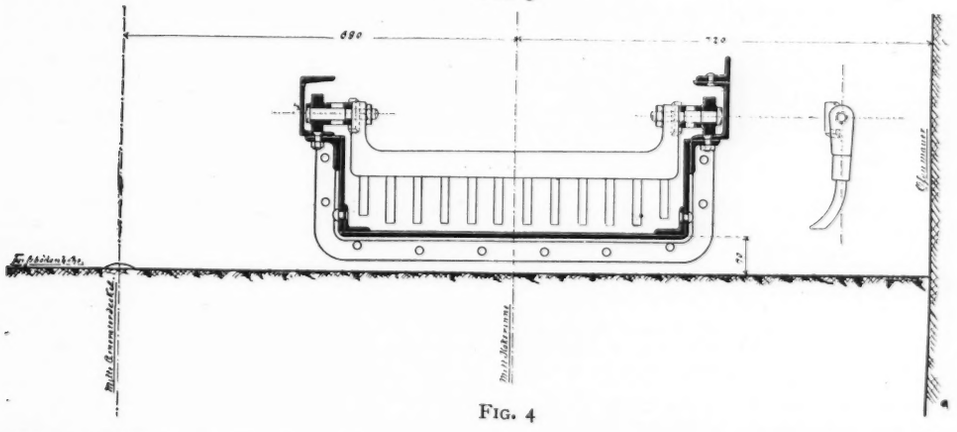


FIG. 4

1.—The chains running on the two sides of the trough had links only 3¼ inches long, and could not stretch, so as to give exactly equal lengths on both sides.

2.—The wear of the running surfaces of the trough and of its sides which are touched by the rivet ends of the cross-bars, and the wear of the chain links, necessitate continual repairs; and now and then the chain and whole parts of the trough have to be entirely renewed.

3.—Both the trough and the chain, in respect of material, weight, and strength of the various parts, do not display the durability to be expected in such an apparatus.

4.—The cross-bars which connect the chains at certain distances apart only catch up the lower portions of the coke. Consequently, that on top mostly falls back over the cross-bars into the space behind. It becomes still worse when the light chain rises a little owing to some obstacle, and then falls back again, breaking into small pieces and dust all the large coke just under the bar.

Such experiences can, naturally, only be gained by long observation of the working. After the 688 days named, the trough had to be almost entirely renewed, and renewals of parts of the chain had previously been made. There have been attempts in various

FIG. 5.

ways to improve the defects of the De Brouwer conveyor, which defects were described almost exactly as stated above by Mr. Archibald Little in the "JOURNAL" for 1901.* The "JOURNAL" also gave a detailed description, accompanied by drawings taken from an article by Heer Bolsius in "Het Gas."† According to this article, improvements were to be made:

(*a*)—In the chain, by using I-shaped links instead of those of right-angled section, or by employing rather higher ⊥-shaped links between each three of the old shallow links, so that the latter no longer slide on the trough.

(*b*)—In the guiding of the chain, by taking away the L-guide-rails on the return course, and replacing them with guide-rollers with graphite lubrication, at 5 ft. to 6 ft. 6 in. apart. Further, by using small rollers at the ends of the cross-bars, so that they have no sliding movement along the trough. Also, to protect the sides of the trough from the falling coke, a Γ iron was to be fixed over the rollers.

(*c*)—In the trough itself, by having double sides and bottom for interchange and renewal; also by employing cast-iron interchangeable bottom plates.

(*d*)—In the admission and distribution of the water used for quenching.

* Vol. LXXVIII., p. 342. † Vol. LXXIX., p. 766.

It will thus be seen that great efforts have been made to improve the De Brouwer conveyor in all its constructional parts, so that it may perform its work properly. In the author's opinion, however, even all these methods will not suffice to give the conveyor the requisite solidity, as well as simplicity of construction. He can only look upon it as improved when the following principles of construction are recognized: (1) All parts of the trough and conveyor which come in contact with the red-hot coke must be made of durable materials, and be so strong that any wear caused by friction, or any bending owing to heat, are out of the question. (2) The coke-conveyor should not slide on the trough, but should run on rollers of such dimensions that the friction between the rollers and the trough bears a proper relation to the strong construction of the different parts of the conveyor and their weight. (3) The chains of the conveyor must have long links; thus ensuring equal lengths of the chains. (4) The use of cross-bars of round or square section is to be avoided on account of their effect on the coke; and an apparatus must therefore be chosen which will take up the coke from the retorts, as it were in a moving box, open at the top, without permitting any movement of the single pieces of coke therein. At the same time, the coke should be carried with it as far as possible. (5) The various parts of the trough and conveyor to be joined together as much as possible by means of screws. (6) The trough and all parts

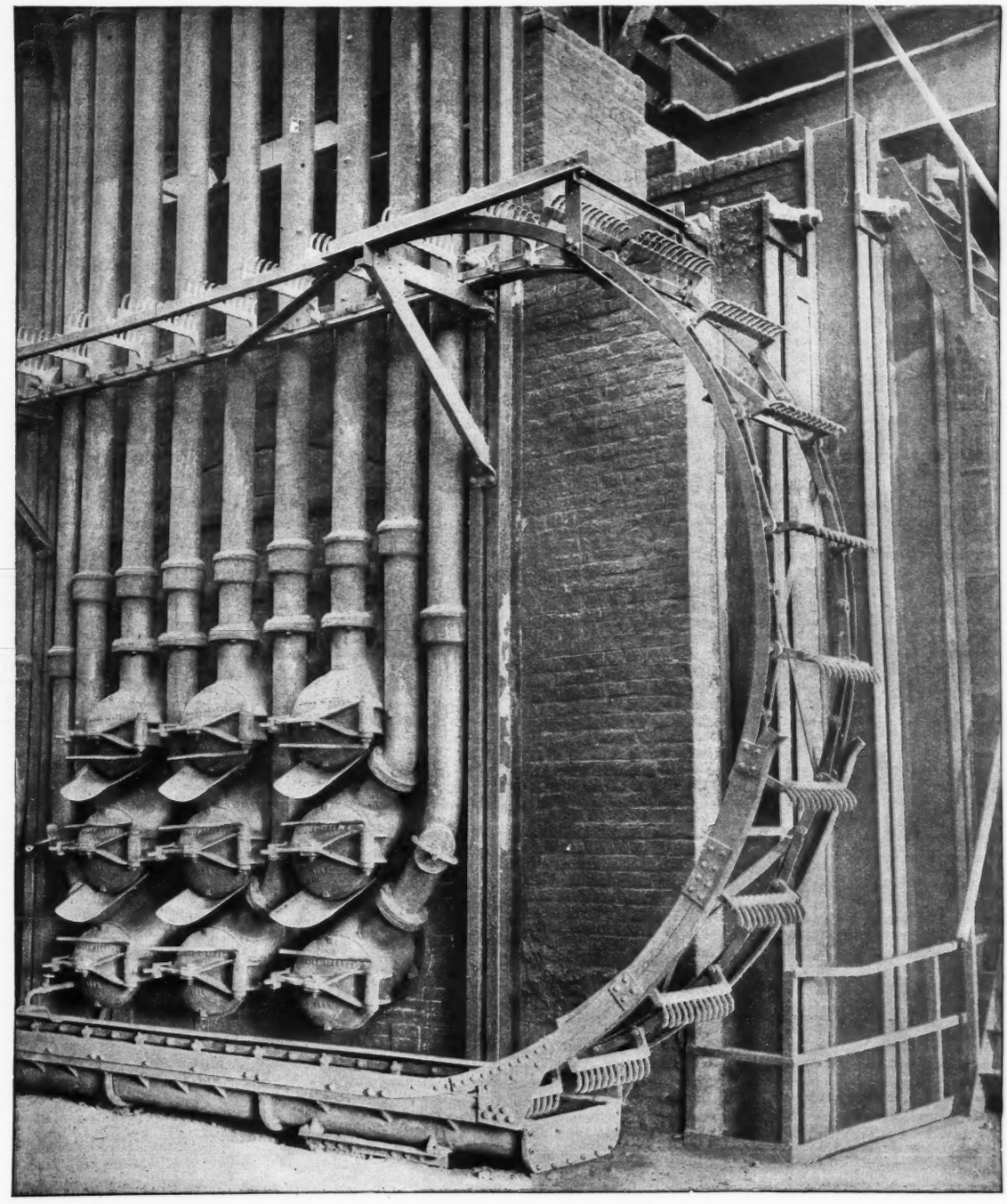


FIG. 6.

of the conveyor must be easy of access. (7) The steam arising from the quenching of the coke must be carried away, so as not to injuriously affect the workmen.

Having these objects in view, the author, at the end of the year 1900, had a coke-conveyer as represented in figs. 1 to 7, fixed in front of the six settings of nines forming the No. 1 bench of retorts. In the course of upwards of 500 days' work, it has fulfilled every requirement in respect of efficiency and soundness of construction. Figs. 1 to 3 show, in cross-section, plan, and longitudinal section, the horizontal stretch of the trough; while fig. 4 represents a section of the rising trough end. Figs. 5 to 7 give three different views of the trough when completed.

The trough *a b b'* (fig. 1) is made of cast iron, and consists of pieces 4 ft. 8 in. long, held together by screws through the flanges. On the edges *b* and *b'*, the chain runs; being protected from the falling coke by the Γ irons *c c'*, which form the box *f* in which the rollers run. The links of the chain are of [] iron, 10 inches long, connected at each second link by rake-like carriers *e e*, which convey the coke along the trough, like forks in the manual transfer of coke. The rollers are fixed to both sides of the carriers by screw-bolts. The movement of the chain only pushes along the coke lying in the bottom of the trough—all the other coke lying over this is carried away, not pushed. As the latter far exceeds the ormer in quantity, and rolling over from the space in front of one rake into that behind never occurs, the whole of the coke is carried along without being subjected to any movement on itself in the space in question; thus absolutely no breaking or crumbling of the coke can take place. The L iron *d* serves as a travelling rail for the moveable baffling screen, which guides to the trough the coke falling from the middle and upper retorts.

From figs. 2 and 3, the extraordinarily simple and solid construction of the chain is apparent. An interchange of any single part is possible, without interrupting work. The chain-links and the connecting-bars are of cast steel; while the rake teeth are of wrought iron. The rollers have hardened bushes; and the screw-bolts which form the axles for these rollers are likewise hardened.

The position of the trough in regard to the generator furnaces is seen from fig. 4. The feeding-door of the generator is brought rather more forward than usual, in order to admit of direct charging with red-hot coke by means of a shoot laid over the trough. The transport of the coke beneath the shoot is not in the least hindered. The coke is quenched in the horizontal course by water-sprinklers placed at every second setting, and by a squirting arrangement at the beginning of the trough (fig. 5), which at the same time frees from dust the chain links

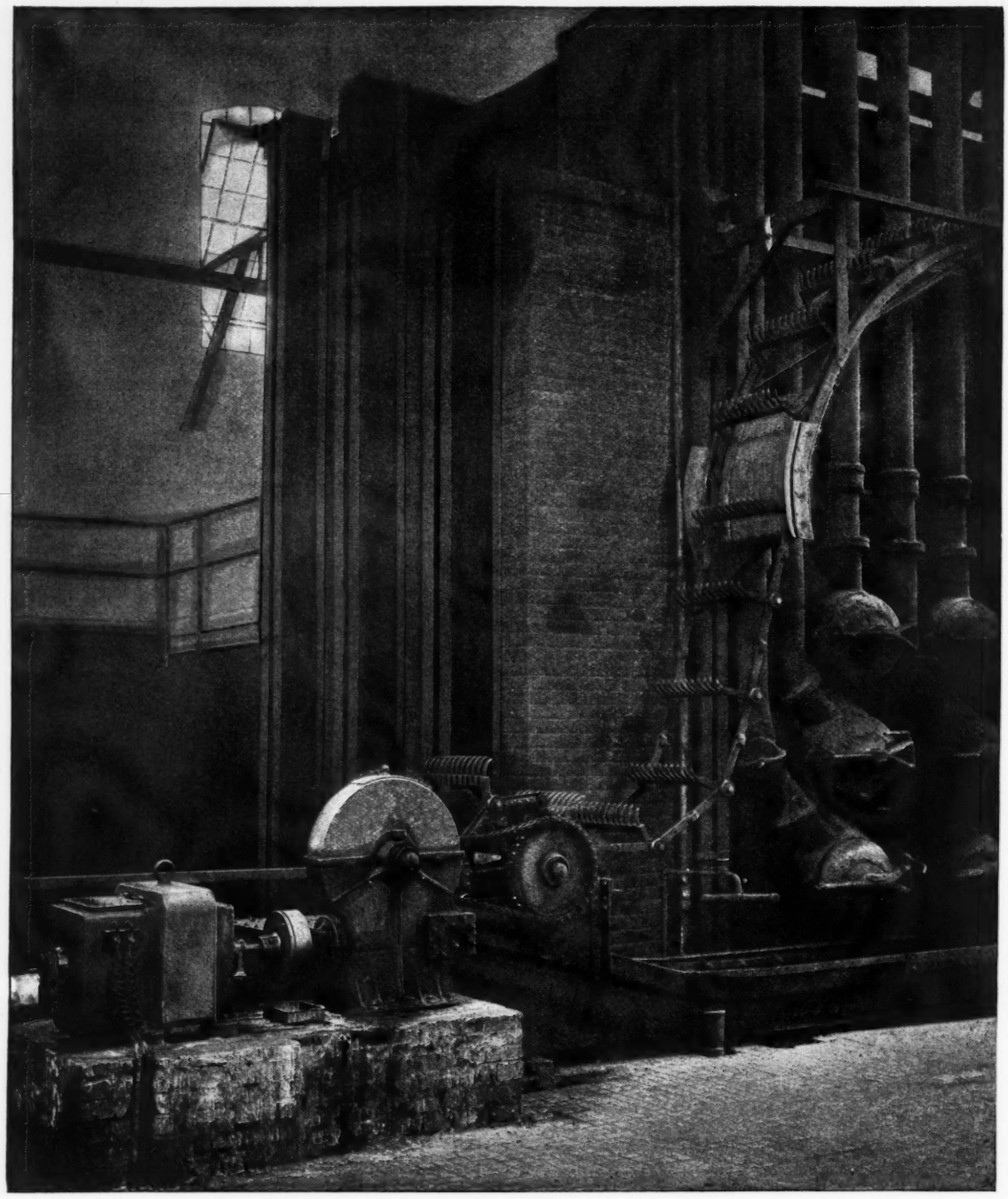


Fig. 7.

and rollers as they pass, and then delivers the water as it flows from the roller-box *f* into the trough, the bottom of which it wets. The water both from the sprinklers and the squirting apparatus collects, so far as it is not evaporated in quenching the coke, at the rising end of the trough, where it flows back and completes the quenching. Any superfluous water passes through an overflow pipe.

It is therefore apparent that the coke falling into the trough is continually being quenched; so that the workmen engaged in front of the retorts are not in the least troubled by the heat. The steam from the trough also does not spread over the retort-house, but is drawn upwards to the warm pipes. The steam from the final quenching at the end of the trough causes no trouble to any one, as no one is at work there. If necessary, however, this steam could be got rid of by fixing a wooden funnel over the end of the trough. The coke falls from the trough into underlying small coke-waggons, which an elevator transports to the coke-store. The quenched coke can, however, be disposed of in any other way adapted to local apparatus and conditions.

The requisite power is obtained from a $3\frac{1}{2}$-horse power electric motor, which drives an encased cog-wheel by means of a spiral wheel. The cog-wheel actuates the octagonal chain drum by a driving chain. The primary engine is a $5\frac{1}{2}$-horse power dynamo, driven by a steam-engine. The power required for the 190 feet length of chain, with its 234 rollers, when fully loaded, is 80 volts at 28 ampères. The new coke-conveyor has now been working uninterruptedly since the 4th of January, 1901, and during that time there have been no expenses for repairs. The only parts which will require renewing every two years are the rollers and screw-bolts. The cost of these would, however, not exceed £20, and the exchange can be effected during working by the ordinary staff of the gas-works. In consequence of the extraordinary success of this new trough, the No. 2 retort-bench, also having six settings of nines, will be furnished with a similar conveyor in the summer of 1902.

The author remarks, in conclusion, that this conveyor can be used equally well for horizontal or inclined retorts, and with the generator in any position.

According to some statistics that have lately been published, there were in the United States, on the 1st of September last year, 2842 electric light stations, employing a capital amounting to no less than $668,830,312.

WATER GAS MANUFACTURE IN THEORY AND PRACTICE.

By Dr. James Kramers.

[Abstract Translation of a Communication published Last Year in "Het Gas."*]

(*Continued from Vol.* LXXIX., *p.* 1783.)

The "Run."

The foregoing is the theoretical basis on which the water-gas apparatus which will now be described, has been designed.

Description of the Apparatus.

This consists substantially of two generators, two regenerators, and one recuperator, as per the annexed figures. Fig. 1 shows the front elevation of the apparatus, with part in section on the line I.—II. of fig. 3. Fig. 2 shows a generator and a regenerator in section, on the line III.—IV. of fig. 3, and the recuperator on the line V.—VI. of fig. 3. Fig. 3 is a plan, part in section.

The generators (A and B) adjoin one another; and behind them, and somewhat higher, are the corresponding regenerators (C and D), which are in connection with the generators. Both regenerators lead into a chamber E; and between this chamber and the recuperator placed over it is a valve V, which can be closed and opened by a lever and a chain. Each generator has a feeding arrangement F and G, for supplying it with fuel, and stokeholes and ashpits. At suitable places, sight-holes H are fixed. The air, which is supplied by a fan, enters the recuperator at I, is heated by the tubes J, and passes through the pipe K out of the recuperator. The main-pipe K has two branches which terminate above the fire (secondary air), and afterwards two arms which supply air below the fire. The air supply can be regulated by the valves L, L^1, L^2, L^3. The steam is supplied through the pipe M, and regulated by the steam-valves. It passes through the little pipe N below the fire. The centre pieces O and P

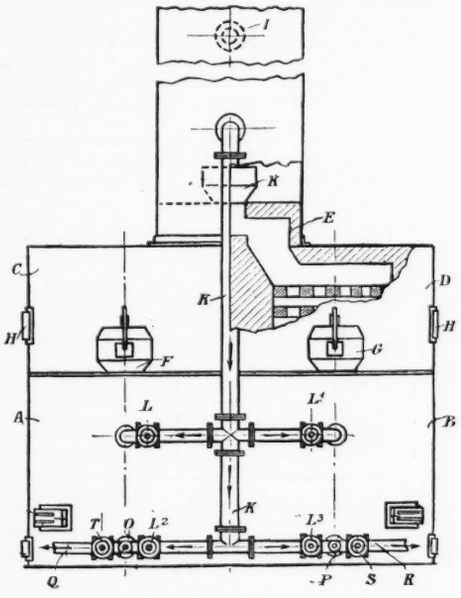


Fig. 1.

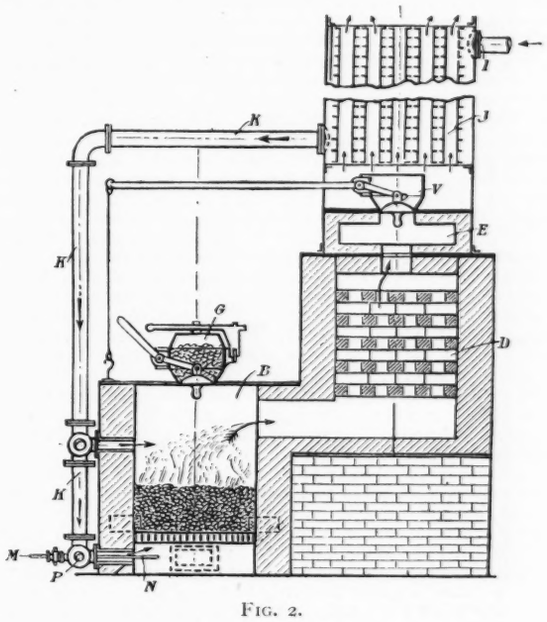


Fig. 2.

are, besides being connected with the steam and air mains, connected with the gas-mains Q and R. These mains can be shut off by the valves S and T, and supply the gas to the condenser and the purifying apparatus.

The action is as follows: Fire is started in both generators; the air-valves L, L^1, L^2, and L^3 are opened (L and L^1 only so far as is necessary to consume the CO formed), as well as the valve V. Both fires are thus blown hot at the same time. The heated products of combustion pass through the regenerators, in which also any CO there might be in the blow gases, is consumed by the secondary air supplied through the branches in the main pipe. The regenerators therefore are also heated. The products of combustion pass through the recuperator, and warm the air in it which is required for the hot blast, and then escape to the chimney, at a temperature of ± 200° C. When the fires in the regenerators are hot, which is ascertained by observing the colour of the regenerators through the sight-holes H, the air-taps and the valve V are closed; a small quantity of coal is thrown into one of the two generators—*e.g.*, into A (just as much as is used by the generator for two "runs" and two "blows"); the cock S is then opened, and steam is admitted under the generator A, by opening the valve. The water gas, that is formed in the generator A, passes through the coals freshly thrown on; and, mixed with the distillation products of the latter, the gas passes successively through the regenerators C and D, through the generator B from top to bottom, and, after having been last in contact with the hottest part of the fire

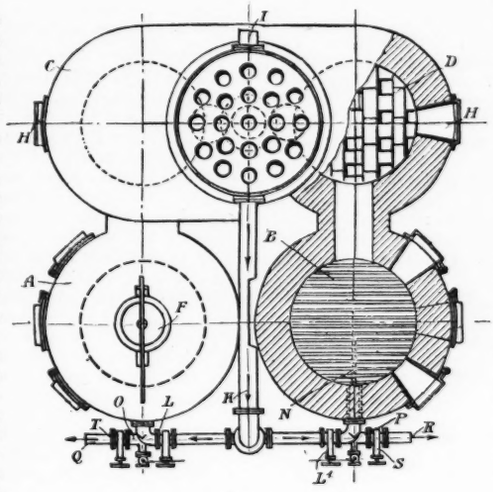


Fig. 3.

of the second generator, passes through S and R to the condenser where it is quickly cooled. This condenser is cooled by water; but the gas does not come in contact with the water. The water which is heated in this condenser is used for feeding the boiler. After a time, the blow is restarted, the steam is shut off, the cock S is likewise shut, and the valve V and the air-valves are opened. After the "blow" a "run" again follows; but coal is then fed into the generator B, and steam is admitted below the latter, while the cock T, instead of S, is opened. Water gas is again formed, which partly decomposes the coal fed into generator B, and then passes successively through the regenerators D and C, and through the generator A from top to bottom. After the second "run," a "blow" follows, and so on; but the "runs" take place in turns in the generators A and B.

It may appear that the reversing of all these cocks occupies much time, and might be omitted by accident. Such an objection is, however, more apparent than real. In practice, various combinations are employed to simplify these movements; and Heer Aarts, of Dongen, has succeeded in making an apparatus by which all the movements of the cocks—reversing, valve closing, and steam admission—are reduced to a single movement. The service is now very simple; and one man can conveniently attend to three sets of apparatus, each of 200 to 300 cubic metres (say, 7000 to 10,500 cubic feet) per hour capacity, while mistakes are quite impossible.

What does the apparatus achieve?

(1) The fire, or rather the fires, are blown very hot; for the air is strongly heated, and the fires are shallow. On account of the high temperature at the time of the "blow," and the relatively great velocity of the air blown in, there is still some CO formed, but much less than with a deep fire. This CO is consumed by

* The author has used throughout chemical symbols in place of the names of elements and compounds; and though such use is open to serious objection, and is contrary to our usual practice, it has been retained *for the sake of brevity* in this translation.—Ed. J.G.L.

the secondary air; and the heat is for the most part retained in the regenerators. Any remaining over is again mostly used up in the recuperator. The utilization of the calories during the blow, therefore, leaves nothing to be desired; and the apparatus combines the advantages of a high fire and a low fire. The advantage of a high fire is chiefly that much heat can be accumulated in it, and the water gas on its formation has a long way to travel. In this respect, two low fires are equivalent to one high fire. The advantage of a low fire is a higher average temperature, because of the greater proportion of CO_2 in the blow gases (the higher temperature is also reached sooner); while the fire is more readily kept clear, and the quality of the fuel of less moment.

(2) On the "run," water is decomposed in the first fire; and the composition of the gas after traversing the first fire (disregarding for the moment the distillation products of the fresh coal) will be about the same as with other water-gas apparatus (perhaps with somewhat more undecomposed steam, and with a somewhat lower average temperature)—*i.e.*, besides CO and H_2, it contains a little CO_2 and undecomposed steam. There is in it therefore: CO, H_2, CO_2, and H_2O. This mixture passes into the regenerators, in which the conversion $CO + H_2O = CO_2 + H_2$ takes place, and almost all the water vapour disappears. In this process, heat is liberated; but, as already stated, the undecomposed steam has not taken up the temperature of the fire, and the gaseous mixture will therefore practically withdraw a large number of calories from the regenerators.

After leaving the regenerators, there is almost solely H_2, CO, and CO_2, and relatively a great deal of CO_2; the water vapour has almost entirely disappeared; and, moreover, the mixture is strongly heated. It now traverses the second fire, when H_2 and CO go through unchanged. But CO_2 is converted with C to 2 CO; so that there only remains the theoretically required quantity of CO_2, dependent on the temperature of the hottest part of the second generator. If the reaction $CO + H_2O = CO_2 + H_2$ has not been complete in the regenerators, then the remaining trace of H_2O, which in any case is heated very highly, is decomposed in the second generator, so that after leaving the apparatus there is no H_2O in the gas. As it does not come into contact with H_2O until after it is cooled to about 100°C., the percentage of CO_2 cannot be increased by the action of H_2O.

(3) The great advantage of blowing steam through the fire, from above to below, during the "run" has already been made apparent (the reason is that the gas must at the last moment come in contact with the hottest part of the fire), although with other water-gas apparatus, working with only one fire, this would not be continuously possible, and it would be necessary now and then to blow steam from below to above. What a disadvantage this must be, both as regards the percentage of CO_2 in the gas made at such a period and as regards the loss of calories in the regenerator (if there is one), must be evident to everyone who has attentively read the above. With the apparatus described, however, the "run" begins alternately in one of the two generators, but always takes place under exactly the same favourable conditions—viz., so that the whole of the heat stored in the regenerators is utilized, and the gas is always at the last moment in contact with the hottest part of one of the generators. This latter, in conjunction with the fact that very little undecomposed steam enters the second generator, is the cause of the percentage of CO_2 in the gas produced being very low.

(4) Obviously, it is an advantage if all sorts of coal can be used. The difficulties which have to be overcome are chiefly due to the occurrence of tar-forming products. There can be no question of using coal in apparatus in which the "run" takes place from below upwards. In apparatus in which, according to the constructors, coal can be used, steam must be employed, which is strongly superheated in regenerators, with the object of abstracting the volatile compounds from the coal. These compounds are afterwards fixed in the fire. It is well known how troublesome this fixing is, as in carburetted water-gas plant very large fixing chambers and superheaters are not built for nothing. Without an extremely high fire, this fixing would be very faulty. In the above apparatus, however, this can take place without difficulty, as the gaseous mixture, which, after it leaves the first generator, is laden with the volatile hydrocarbons of the coal, must first traverse the two regenerators before it goes down through the fire. In reality, the fixing takes place before the gas comes into the second generator; and in the latter only still higher hydrocarbons, which are not susceptible of direct fixing, and under other conditions would settle out as tar, are for the most part decomposed into C and H_2. This C is probably used first (on account of its very finely-divided condition) for the reduction of the CO_2 which is present. Practically there remain almost exclusively CO, H_2, and a little CH_4.

A survey has now been taken of what theory and practice teach about the reactions which occur in the water-gas process. In the theoretical discussions, it has been assumed that carbon is always used; and in practice this is very nearly secured by using coke. There is still too little known about the theory of fixing to discuss it in detail. Therefore, in the theoretical discussion, the use of coal has not been considered; but in the apparatus described coal can be used with advantage. It is well adapted for this, on account of the special arrangement of the regenerators, which it is believed, does not occur with any other system. In fact, the regenerators can at the same time be regarded as fixing chambers and superheaters.

SOME MODERN COMPETITORS WITH COAL GAS.

By A. Lecomte, of Paris.

[A Paper read before the Recent Congress of the Société Technique du Gaz en France.]

In the following paper, which is a continuation of that presented to the International Gas Congress in 1900,* I propose to bring up to date such technical details in regard to the illuminants, carburetted gas, "alcoholene," petroleum, and alcohol, as may interest gas managers. Of these competitors with coal gas, alcohol has made the most distinct strides since the date of my previous paper; and I shall, therefore, devote most attention to it in the present contribution.

But I will first briefly consider the hydrocarbons now used in the manufacture of air gas. For some time past, gasoline or light petroleum has headed the list of the liquids used for this purpose on the dual basis of price and calorific power. Now, however, benzol or benzene (as it is also called) commences to compete with the older hydrocarbon. It is very rich in carbon, has a high calorific power, is cheap, but unfortunately possesses a low vapour tension. Though it scarcely seems able to replace gasoline entirely, it may enter into the composition of the gasifying liquid to the extent of a half or one-third.

Under the name of "alcoholene," the well-known compound, sulphuric ether ($C_4H_{10}O$) has been adopted by M. Bouchaud-Praceiq. The relative values of these three products can be judged from the following tables:—

Properties of Benzol, Gasoline, and Ether.

Liquid.	Density at 15°.	Flash Point.	Boiling Point.	Total Heat of Vaporization.	Total Heat of Combustion Products at 0°.	Total Heat of Combustion Products at 100°.	Weight of 1 litre of Vapour at 0° & 760.
		C.	C.				Gm.
Benzol, 96 per cent. . . .	·880	−15°	82°	132	10,090	9,565	3·50
Gasoline . .	·680	−20°	70°	153	12,168	11,210	3·85
Ether . . .	·720	−20°	35°	109·8	8,700	8,040	3·40

Vapour Tension of Benzol, Gasoline, and Ether.

Liquid.	Density at 13° C.	Observer.	Vapour Tension in mm. of Mercury. −20°.	−10°.	−5°.	0.	5°.	10°.	15°.	20°.	25°.	30.
Benzol, 90 per cent.	·880	Desvignes	—	—	18	25	34	45	59	75	96	121
Gasoline .	·680	,,	—	—	69	80	95	113	140	167	195	222
Ether . .	·720	A. Witz	69	112	145	182	231	282	333	432	—	635

From these tables one can calculate that important factor, the quantity of the combustible liquid which can be taken up by the cubic metre of air. This is done by the rule that in such a saturated mixture the volume of dissolved vapour is proportional to the vapour tension at the given temperature, and to the pressure of the mixture. It will thus be seen that 1 cubic metre of air at 0° can contain no less than 1·26 kilos. of ether; so that a gas can be compounded from this product which will not undergo condensation under any circumstances.

In evaporating these hydrocarbons by the dry method, a new carburettor—that of Laitte—has appeared. It consists of a series of inclined planes, placed, accordion fashion, one after the other. The air and hydrocarbon are admitted at the upper end, and travel together in such a manner that the liquid is completely evaporated by the time the other end of the apparatus is reached. The heat is dissipated to a certain extent by the surfaces of the inclined planes; and in practical working it is found that an appreciable time is required for the volatilization of the liquid. The time depends on the vapour tension of the hydrocarbon, on the surface-area of the carburettor, and on the surrounding temperature. With petroleum of ·680 sp. gr. and a difference of 5°C., the time is from 12 to 15 seconds for a saturation of 350 grains per cubic metre.

A special kind of carburettor for use with ether has been constructed by M. Bouchaud-Praceiq, under the name "Bidon à Sondage." Air is forced in at a pressure of 2 or 3 cm.; but the remarkable feature about the apparatus is the material on which the volatile liquid is exposed to the gaseous current. This is a wood—or, rather, fibre—of a tree allied to the palm. Its density is ·114 or ·122; and it is extremely porous, absorbing nine times its weight of liquid, and discharging the same completely by subsequent evaporation.

The material, which is known as "bois Bouchaud," is interesting from the fact that, by means of it, the weight of the absorbent body can be made quite small in comparison with that of the liquid absorbed.

Ether may well have a future in France; for, according to

* See "Journal" for Oct. 16, 1900, p. 955.

M. Bouchaud-Praceiq, it can be produced for 49·78 frs. per 100 kilos., and should be procurable at 55 frs. per 100 kilos. from the distillers. At present the price is 65 frs. per 100 kilos, and all calculations in this paper are based on this figure.

Experiments with Ether Gas (Gaz Alcoolène) by M. Langlois, at Rocourt (St. Quentin) seem to establish the figure of about 6·7 grains of ether per carcel-hour, when the gas is consumed in an incandescent burner. Its immunity from condensation was tested by pumping it through an apparatus cooled to as low as—6° C; and an hour's test under these conditions failed to extract a drop of condensed liquid from it. Photometric tests were made on the cooled and uncooled gas without any difference being found. The practical conclusion seems to be that an installation of not more than 500 burners is suitable for a small town or factory. On dilution with air, ether loses its luminous flame, but any required degree of luminosity can be obtained by using a small benzol carburettor, which yields a gas similar to oil gas, requires the expenditure of only 40 or 50 grains of benzol per cubic metre, and supplies gas which is as stable as any consumed in our burners. As regards the commercial use of ether air-gas, enriched with benzol, the cost of production works out at about twice the price of oil gas; and the most direct advantage to be gained from it is in the ease and rapidity with which a small plant may be installed to replace (say) a furnace, while repairs are being executed.

The attention of gas makers was first drawn to mineralized alcohol by M. Th. Vautier, and was further studied by M. Ph. Delahaye in 1887. At the present time, alcohol is a practical source of light and heat; and the chief thanks for the extraordinary industrial development of its application in these particulars must be given to M. Jean Dupuy, who inaugurated the mineralized spirit in France. It is to the interest of the gas industry to favour the production of alcohol; for, as with an average beet crop, a hectare of land produces from 28 to 30 hectolitres of alcohol, and as an expenditure of 130 kilogrammes of

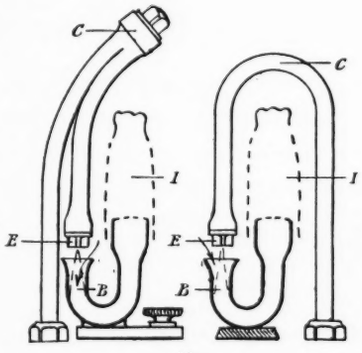


FIG. 1.

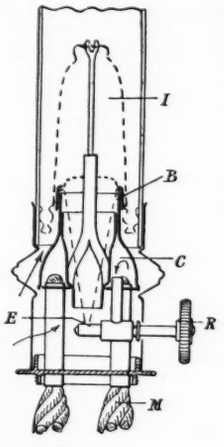


FIG. 2.

sulphate of ammonia is required for this area of land, it follows that, for every hectolitre of alcohol produced, 5 kilos of sulphate are sold.

In admixture with benzol, alcohol is a less expensive motive power than when used alone. This carburetted spirit is much employed for automobiles, which fact may not, however, greatly interest gas managers. But this further item should interest them—viz., the question whether carburetted alcohol is a cheaper source of power for fixed motors than ordinary lighting gas. The measurements of M. Sorel show a yield of 4900 calories per litre of mineralized spirit and 6700 calories per litre of spirit carburetted with 50 per cent. of benzol. Tests on motors showed that, on the basis of 800 litres per horse-power-hour for motors from 1 to 5 horse power and 700 litres per horse-power-hour for motors from 6 to 16 horse power, alcohol works out as equal to gas at 22·5 and 25·5 centimes. Among the appliances used for heating by alcohol, the Lecomte stove (made by A. Decamp and Co.) enables a litre of water to be brought to the boil in 8·5 minutes, with the expenditure of 35 grains. With carburetted (50 per cent.) alcohol, the time is 12 minutes, and the spirit 20 grains. These figures work out to correspond with gas-stoves using gas at 48 centimes and 28 centimes.

Incandescent lighting with petroleum hydrocarbons has made very little progress since 1900; but there is one lamp on the market which gives very good results. This is the burner of the Administration des Phares, worked out by M. Ribière, and made by M. Luchaire. It consists of a curved tube G, which serves as the heater. The burner B is movable, and can be withdrawn from beneath the vaporizer; its exact position being fixed by a screw. The ejector E is one with G, and is fixed by a triple union joint. In order to start the burner, the whole is filled with alcohol, and the hydrocarbon is afterwards admitted under a pressure of 2 to 4 kilos. The paraffin oil is vaporized in C, arrives at the ejector E, where it draws in air, and proceeds in admixture with the latter to the burner I. The flame maintains the temperature of the tube C, and so vaporizes hydrocarbon in proportion to the quantity consumed. A high-flash oil is used; the reservoir containing it being so arranged that the supply is regulated by the pressure of air in the regulator. A 35-carcel incandescent light is produced for 175 grains—*i.e.*, a carcel-hour for 0·2 centime. With mantles of 85 min. diameter, a light of 135 carcels is obtained at the extraordinary efficiency of 3·5 to 4 per carcel-hour.

Of incandescent lamps for alcohol the following are the chief types; Pressure lamps (Denayrouze, Hantz, and Washington systems). Those appliances give from 10 to 103 carcels with an efficiency of 15 grains of mineralized alcohol per carcel-hour (with a minimum of 10 grains); or 10 grains of carburetted alcohol (50 per cent.) with a minimum of 5 grains—*i.e.*, at 0·7 to 0·5 centime for mineralized alcohol, or 0·5 to 0·25 centime for carburetted alcohol. This is equal to from 10 to 15 litres of gas at 0·20.

Under the name "Pétréano," a lamp is sold consisting of an Argand burner provided with deflectors, in order to introduce sufficient air into the alcohol flame to enable it to raise the mantle to incandescence. The Germans have recently manufactured a lamp of the kind under the name of "Reform." But it is very difficult to regulate the flame of these burners. The wick must be cut very straight, and a tall chimney is necessary. The consumption is very high—about 50 grains per carcel-hour.

The Denayrouze "Alvéolaire" lamp (new model) is of simple construction, and gives very good results with 50 per cent. carburetted alcohol. It works without pressure, and is therefore suited for domestic purposes. Two wicks are used; the vapours rushing in a chamber above their upper extremities. For intensities of 0·36 to 8·5 carcels, the mean consumption is 10·7 grains. per carcel and per hour.

The Lecomte burner (made by M. Decamps and Co.) is shown in fig. 2. It consists of three pieces for moving the heater C, into which enter the four wick-tubes M. A cock R controls the supply of alcohol vapour escaping from the ejector E to the burner B. The alcohol is fed by capillarity, which does not prevent the pressure of alcohol in the heater reaching 6 cm of water. The efficiency of the lamp has been found to be 71 candles Violle—say, 7·38 carcels per 72 grains, or 9·75 grains per carcel-hour. The small burner gives 4·16 carcels for 44·4 grains, or 10·7 grains per carcel-hour.

The general conclusion is that alcohol and other lamps have by no means reached their limit of efficiency. But as it is these competitors with coal gas are more serious rivals than oil, electricity, or acetylene; and it will only be possible to successfully oppose them by making oneself thoroughly familiar with their strong and weak points.

MECHANICALLY SEPARATING TAR AND LIQUOR.

The difficulties experienced, even with a considerable amount of rest, in separating ammoniacal liquor from the tar with which it is incorporated—especially when the tar is the product of the distillation of coal at a high temperature, and is consequently thick and wanting in fluidity—are well known to gas managers. If it is to be distilled, the operation is sometimes very difficult, owing to the liquor held in suspension, which necessitates the use of extra fuel; while if it is employed for painting ironwork, the liquor causes oxidation of the metal. At the last meeting of the Société Technique, M. Burguière described the Hignette turbine, by the use of which it is possible, according to him, to free the tar from nearly the whole of the liquor. The following is a brief account of the appliance: A cylindrical receptacle, supported and worked on a vertical shaft, is filled with the tar, previously heated to 40° C. by means of a plunger pipe fixed in the central part. This vessel revolves at the rate of 2400 revolutions per minute. Four vertical blades, placed in the direction of two perpendicular planes, are fixed on the circumference of the receptacle, but without touching it. The liquor carried away by the blades acquires in an instant the speed of the vessel, and assumes the form of a ring, the inner part of which is composed of the light, and the outer part of the thick or heavy liquid. Two pipes are placed in these two positions on the lid of the vessel, through which they run, and are bent at right angles immediately below, so as to present their mouths in the opposite direction to the flow of the liquor. The result is that, under the influence of centrifugal force, the tar and liquor are discharged in two different directions in the form of jets moving at very great speed. The tar is thus freed from the liquor to the extent of containing only 1 per cent.

The turbine which has been put up at the Marseilles Gas-Works is equal to treating about 16 cwt. of tar per hour; but projection of the heavy molecules against the sides of the vessel favours a deposit upon them of small particles of soot, which imperceptibly thickens, until, owing to the circulation of the liquor round the blades being impeded, a general cleaning of the apparatus becomes necessary. This takes nearly an hour, and immediately afterwards a fresh operation can be started, which lasts about two hours. It may thus be reckoned that the amount of tar treated in ten hours will be about 6 tons 8 cwt. The man who attends to the tar and liquor can also do this work, at an increase of wages. The extra expenses are then confined to the

fuel employed to drive a small 5-horse power engine and a tar-pump. The author estimated the cost at about 3 frs. per working day of 10 hours, or 47 c. per metric ton (2200 lbs.) of tar. The quantity of liquor recovered is considerable enough to be mentioned. The turbine removed about 11 cwt., from which 22 lbs. of ammonia could be extracted.

The general plant comprises a small shed (large enough to contain two turbines); one turbine; a tar-tank in which a steam worm raises the temperature to about 40° C; a tank to receive the tar after treatment; a 4 to 5 horse power engine; and a pump to drive the tar into the general storage tank. The total cost was 6600 frs. (£264).

UTILIZATION OF RETORT CARBON.

In the course of the past quarter-of-a-century, numerous examples have presented themselves of the profitable utilization of what were at one time waste products in manufacturing operations. One of the most recent, so far as the gas industry is concerned, is that of retort carbon, which is now much in demand in certain branches of what may be regarded as antagonistic industries; being extensively employed in the electrical extraction of aluminium, as well as for the electrodes used in the furnaces where calcium carbide is produced. These electrodes are made in Greenock, in what was at one time a sugar-house or refinery. The place seemed specially suited for carrying on the industry. The ground enclosed within the walls covers an area of between three and four acres, and along one of its boundaries there is one of the Greenock water-courses, which supplies a number of industrial establishments; the carbon factory employing 32-horse power. In the production of the electrodes, the retort carbon is broken small and ground very fine under edge rollers, and then mixed with tar to the condition of stiff dough—another connection with the gas industry. The tar and carbon dough is pressed into cast-iron moulds; the pressure employed being from about a ton upwards per square inch. When these electrodes are drawn from the moulds, they are found to be very firm and hard. They are passed through the furnace for a period of about seven days, where they are exposed to a white heat, obtained from a flame produced by Dowson gas. At first the fuel used was anthracite; but it has since been found that gas coke of the better qualities suffices equally well. There are two producers, each having a capacity of about a ton of coke, which it is desirable should be produced from coal rather than cannel. This coke is purchased at the usual prices, and it generally comes from short distances; but the carbon is brought from every important seat of the gas industry—Glasgow having supplied about 200 tons in the course of a year. Quite one-half of the retort carbon made in the United Kingdom is brought to the electric works. It has been obtainable within recent times at from 5s. to 60s. per ton; but generally the price ranges from 25s. to 50s. There is practically no other outlet for the carbon than for the making of electrodes in this country.

The mineral-oil works of Linlithgowshire and Edinburghshire have found a substitute for retort carbon, which is said to be rather superior to it. It is the last residue in the oil-refining processes. Distillation is carried on until a sort of pitch coke is formed, which has recently come into use. In the meantime, Young's oil-works, and those of the Pumpherston and Oakbank Oil Companies, as well as others, are finding a ready sale for their pitch coke residue. When this material is received at the works, it is subjected to a rough-and-ready method of preparing it for making electrodes. It undergoes firing in a vertical stack, until every particle of oleaginous matter is burned off, and the solid remainder is removed to the edge rolling-pan and ground to dust ready for admixture with the tar.

The electrodes used in the production of aluminium weigh about 270 lbs. each, and they go on for a time in the furnaces at Foyers; but eventually stumps are left which can no longer be used, and they are returned to the Greenock works. But there are electrodes of less weight—72 lbs.—which are used in the making of certain carbide; the bigger ones being 4 ft. by 10 in. by 10 in. The Company own a steamer of 200 tons, which carries them and other material to or from the works at Foyers.

MEETING OF GAS ENGINEERS AT HALBERSTADT, IN SAXONY.

A General Meeting of the Association of Gas and Water Engineers of Saxony and Thuringia has been held at Halberstadt, under the presidency of Herr Achtermann, Manager of the Annaberg Gas-Works. We take the following particulars of the proceedings from the "Journal für Gasbeleuchtung."

Herr J. Körting, of Hanover, read a paper on "Large Gas-Engines and Producer Gas Plant." He gave many interesting details relating mostly to construction, and an animated debate ensued. Dr. Pfeiffer, of Magdeburg, next gave an account of the water supply of his town from the commencement to the present time, and also referred to the plans for a well water supply, which has been rendered necessary by the salting of the River Elbe. Dr. Lang, of Gotha, spoke on the question of schools of instruction for gas-fitters, and the position taken up by the various branch Associations in regard to this question. The President called attention to the fact that the "ordinance of Dec. 12, 1856, concerning police regulations in Saxony as to the preparation, use, and storage of easily inflammable or explodable substances and preparations" contained clauses by no means suited to present-day conditions. The Committee were asked to petition the Ministry of the Interior to expunge the clauses named. Herr Ledig, of Chemnitz, stated his experiences of the last two years with cyanide washing. While formerly only 55 per cent. of the cyanide in the gas was obtained through the oxide in dry purification, the yield with cyanide washing amounted to about 98 per cent. Although about one-third of the total ammonia was retained in the washer, as well as the cyanide, yet that could be recovered by boiling the cyanide sludge. Herr Herzfeld, of Halle, pointed out that the gasification of brown coal (lignite) would become of great importance if a permanent gas could be successfully produced from it, and he recommended that greater attention be given to this question. Herr Blum, of Berlin, however, declared that experiments made with a gas-engine of 200-horse power working with brown coal gas, in the works of the Berlin-Anhalt Engineering Company, had up the present proved very unprofitable. Dr. Lang, of Gotha, Herr Fähndrich, of Dessau, and Herr Zinck, of Halberstadt, gave reports of successful experiences with naphthalene washers; Herr Bessin, of Berlin, spoke on the admission of air to purifiers; Herr Blum, of Berlin, on dry seals for purifying vessels; Herr Weber, of Hamburg, on igniting burners at a distance on the Nebendahl system; and Herr Ledig, of Chemnitz, and Dr. Lang, of Gotha, on experiences with other igniting systems for distant street-lamps.

Nine new members and eighteen associates were elected at the meeting, so that there are now 104 members and 73 associates in the Association. It was resolved to hold a summer meeting this year—in the latter half of September, if possible. There was some prospect of it being at Coburg, in response to an invitation from the Mayor of that place.

AUSTRIA-HUNGARY GAS ASSOCIATION.

General Meeting.

The Twenty-first Annual General Meeting of the Association of Gas and Water Engineers of Austria-Hungary was held at Vienna on May 27 and 28, when about seventy members and visitors attended. On the first day, the meeting was opened in the Salon of the Vienna Mercantile Association, by the President, Herr G. Wobbe, the Manager of the Municipal Gas-Works. The report for the past year was first dealt with. It showed a membership at the close of the year of 160—being an increase of 19 within the twelve months. Olmütz, the ecclesiastical capital of Moravia, was chosen as the place for next year's meeting.

According to "Der Gastechniker," the official organ of the Association, the technical proceedings, of which the programme was given in the "JOURNAL" for May 27 (p. 1423), were carried out as follows: The first paper read was that of Herr G. Koss, of Ezer, on "Obstructions of Water-Pipes by Roots, &c." Then Herr Blum, of Berlin, gave his paper on "Pressure-Regulators;" and he was followed by Captain Walter, Professor at the Military Academy, who gave a lecture which induced a very lively discussion. The first day's proceedings concluded with an excursion to Weidlingbach. The next day Herr Bernauer, of Budapest, first read a paper on "Lighting Devices for Incandescent Street-Lamps," which was discussed at considerable length. Then Dr. H. Strache gave his communication on "Automatic Gas Analysis," and the President read his paper entitled "Novelties in the Application of Gas to Cooking and Heating." Herr Horn telegraphed to the meeting that, owing to an accident, he was unable to read his promised contribution on "Furnace Construction;" while illness prevented Herr Zelle from presenting his communication on "Heating Appliances." The President came to the assistance of the meeting with a short address; and then Herr Theodorowics dealt with a set of rules for the use of gas proposed by the Association of Engineers and Architects. After discussion of this question, the meeting closed with a vote of thanks to the President.

We hope to give abstracts of the more important of the papers read at the meeting, as soon as they are published in our Austrian contemporary.

It will no doubt interest Mr. John Dempster's many personal friends to learn that, in the Dover to Heligoland yacht race for the German Emperor's Cup, his yacht, the "Vol-au-Vent," was declared the winner on time allowance. Mr. Dempster, who is to be heartily congratulated upon his good fortune, was personally presented with the Cup by the Emperor last Saturday.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

The Naphthalene Problem at Plymouth.

SIR,—I have noted your remarks on the naphthalene problem at Plymouth in the "JOURNAL" for June 24. As they rather suggest that the method which we are about to adopt is due to some originality on my part, I hasten to assure you that such is not the case.

The facts are simply these: During the autumn of last year, I carried out a series of experiments, on both a laboratory and working scale, with a view to testing the efficiency of the "heavy oil process" of Messrs. Young and Glover for the extraction of naphthalene from coal gas. The results were of a very satisfactory nature; so much so that my Directors decided to lay down the apparatus necessary for treating the whole of our make of coal gas by the above process.

I do not anticipate that the plant, which is now in the hands of the makers, will be in working order before the commencement of the coming winter, and even then some months must, I am of opinion, elapse before we begin to feel any material benefit in our district. Should this happy result be attained, I shall then be glad to take the opportunity, as you suggest, of adding our experience at Plymouth to the common stock.

P. S. HOYTE, Engineer.

Gas Works, Plymouth, June 25, 1902.

Sons of the Gas Industry.

SIR,—The recent letters on the above subject by Mr. Halliwell and "Douglas" unfortunately do not appear to have resulted in anything being done to effect the desired modernization and general betterment of the juniors of London and district. It seems almost incredible that Manchester should be so far in advance of the Metropolis in this respect, and can so proudly point to the excellent Association existing there for the further technical education of the aspiring "gas junior" of that district.

That such an organization is helpful, goes without saying (notwithstanding "Marmion's" supremely-contented views to the contrary); and I feel certain that, if a similar Society were promoted for London and district, it would be equally successful, since there must be a considerable number of "eligibles" in and around the Metropolis, and I cannot believe that they would hold aloof were they to realize the benefits accruing from their connection with it. The reading of papers, with the open discussion arising therefrom, together with the occasional visits to works where the most modern apparatus and methods of working have been introduced, must undoubtedly go a long way towards extending one's knowledge and broadening one's ideas generally, and in every way to improve and better prepare the junior for the satisfactory occupancy of the position to which he hopes ultimately to attain.

While conversing recently with some "sons of the gas industry," I was asked if I could ascertain by some means or other whether an Association (on the same lines, broadly speaking, as the Manchester and District Junior) could not be formed for the Metropolitan district. There is, of course, much to be done in the promotion of such an Association; but, in my opinion, the first step will be to obtain the names and addresses of those willing to support the project, when, should a sufficiency be received, a meeting would be convened for a thorough discussion of the matter.

With this object in view, therefore, I invite letters containing expressions of opinion on the subject (favourable or otherwise), which should be directed to my private address as under; and in order that those to whom I am unknown may adjudge of my credentials, I may say I occupy the position of Assistant to Messrs. Stevenson and Burstal, of Westminster.

J. M. CAMPBELL.

54, *Marney Road, Clapham Common, S.W., June 27, 1902.*

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills reported: Ticehurst Water Bill, Ystradfellte Water Bill.

Bills read the third time and passed: Gas Orders Confirmation Bill (No. 2), Chigwell, Loughton, and Woodford Gas Bill, Kent Water Bill, Knaresborough Improvement Bill, Water Orders Confirmation Bill (No. 1), West Ham Gas Bill, Ystradfellte Water Bill.

Bills Royal Assented: Abercarn Urban District Gas Bill, Abertillery Urban District Council Bill, Barking Gas Bill, Birkenhead Corporation Bill, Birmingham Corporation Water Bill, Bournemouth Gas and Water Bill, Bradford-on-Avon Gas Bill, Bromley Gas Bill, Caterham and District Gas Bill, Chigwell, Loughton, and Woodford Gas Bill, Coatbridge Gas Order Confirmation Bill, Darley Dale Water Bill, Deal and Walmer Gas Bill, Fareham Gas Bill, Grand Junction Water Bill, Higham Ferrers and Rushden Water Board Bill, Leyland and Farington Gas Bill, Limpsfield and Oxted Water Bill, Longwood Gas Bill, Newcastle and Gateshead Water Bill, North Warwickshire Water Bill, Reading Gas Bill, Shepton Mallet Gas Bill, Street Urban District Council Water Bill, Swansea Corporation Water Bill, Swindon United Gas Bill, Wadhurst Gas Bill, Wrexham Water Bill.

The Gas Orders Confirmation Bill (No. 2), has been referred to a Select Committee, consisting of Lord Fermanagh (Chairman), the Marquis of Winchester, Earl Bathurst, Lord Steward of Garlies, and the Marquis of Bristol; to meet to-day.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Lords Bills read the first time and referred to the Examiners: Gas Orders Confirmation Bill (No. 2), Water Orders Confirmation Bill (No. 1).

Lords Bills read a second time and committed: Consett Water Bill, Devonport Corporation (Water) Bill, Gas Orders Confirmation Bill (No. 1), Whitstable Improvement Bill.

Lords Bills read the third time and passed: Bradford Corporation Bill, Rickmansworth Gas Bill.

HOUSE OF LORDS COMMITTEE.

Wednesday, June 11.

(*Before Lord* BROUGHAM AND VAUX, *Chairman, Lord* MUNCASTER, *Lord* COLCHESTER, *the Earl of* ROMNEY, *and Lord* NORTH.)

KENT WATER BILL.

This was a Bill promoted by the Kent Water Company for capital powers, to enable them to carry on their undertaking until the concern is taken over by the Water Board—the Company being one of those included in Government Water Bill.

Mr. LITTLER, K.C., and Mr. LEWIS COWARD, K.C., represented the promoters; Lord ROBERT CECIL, K.C., and Mr. CLARKE WILLIAMS, the Kent Water Preservation Association; and Mr. DU CANE appeared for the Godstone Rural District Council, on a petition against alteration in the Bill.

Mr. LITTLER, in opening, said the business of the Company had increased very largely during recent years. For example, in 1886 the number of supplies was 68,000; and in 1896 it was 84,000, or an increase of 1600 per annum. In the past five years the increase had been 3322; and in addition to this the population had largely increased. It was absolutely necessary that they should have more funds. The authorized capital was £1,050,000, in addition to which they had received, as premium, £100,644; making a total of £1,150,644. The whole of this sum had been expended, with the exception of £3613. They wanted to do certain things to carry on their works. They required a new 30-inch main for about 12 miles of their district, and smaller mains in other places. They needed a water-tower at Shooter's Hill, a reservoir at Bickley, and other works. They were asking for £150,000 of debenture stock. The only other object of the Bill was to extend the water-works at Tatsfield, where they had undertaken the control of a supply which had hitherto been in private hands. In the other House, the promoters had no fewer than eleven different authorities opposing them, for one reason or another—including the London County Council; but none of these bodies were now troubling their Lordships. The Local Government Board, who were promoting the London Water Bill, were now satisfied with the measure, and therefore one would have thought that the Company would have had peace. But a number of gentlemen had formed an Association apparently for the express purpose of opposing the measure, because they only came into existence in April last; the Bill having passed the House of Commons in March. What business it was of theirs to oppose the Bill he did not know; but here they were, and he would ask the Committee to examine their petition. They came before their Lordships as the Kent Water Preservation Association; and he maintained that, as such, they had no *locus standi*, seeing that it had required a special Standing Order of their Lordships' House to enable even a County Council to appear against a Bill relating to water. The petitioners did not say how they were constituted or what their interests were. These persons were the only opponents.

The CHAIRMAN: Was this petition before the other House?

Mr. LITTLER replied in the negative. They were a philanthropic body who, he was told, met at the Cannon Street Hotel and resolved that they would worry the promoters.

Lord R. CECIL denied that his clients were "speculative solicitors" or philanthropic inhabitants of Northumberland. They comprised a large number of landowners and millowners resident in this portion of Kent.

Mr. LITTLER said the fact should have been stated in the petition.

The CHAIRMAN: Your point is that their position ought to have been designated in the petition?

Mr. LITTLER: Yes. The Chairman (Richard B. Berens) and the Secretary (Clayton Beadle) are the only names that we know of; and it is not alleged that even they own an inch of land in the county.

Lord R. CECIL said the objection was a purely technical one. The petitioners alleged that they lived in the Cray Valley, and in paragraph 12 of their petition they said: "Your petitioners submit that, looking to the grave injury which Kent has experienced in the past by the extensive and uncontrolled pumping operations of the Company, no further powers should be conferred upon the Company which would enable them to still further denude the district of that water to which the inhabitants are justly entitled, and upon which they are solely dependent." He pointed out that the list of members of the Kent Water Preservation Association was headed by Lord Avebury. Other members were the Hon. and Rev. E. Lee Bligh, the Brasted Paper Mills Company, Mr. Richard B. Berens, the High Sheriff of the

County of Kent, F. S. W. Cornwallis, Vavasour Earle, Col. English, Lady George Gordon Lennox, and Lord Harris.

The Committee deliberated on the question of the *locus standi* of the petitioners, and finally decided to hear them.

Mr. *Alexander Dickson*, a Director of the Kent Water-Works Company, was the first witness. He testified to the excellence and purity of the Company's water, stating that one Royal Commission had reported that the distribution of water of such quality throughout the Metropolis would be a priceless boon. The opposition of the local authorities to the Bill had been abandoned, they being satisfied with the supply both as to quality and quantity. He pointed out that the water supplies of the Company and the population of the area supplied had enormously increased during recent years, and that further capital was urgently needed to carry on the Company pending its absorption under the Water Bill of the Government. They had only £3613 in hand. They sought power to raise £150,000 of additional debenture capital. They had originally asked for £300,000; but the Local Government Board had objected, and submitted that they should only be allowed sufficient new capital to serve them until they would be taken over by the new Water Board. As to the petition of the Kent Water Preservation Association, he could not see that it represented the water consumers at all. Witness explained the grounds for the proposed extension of the Company's supply on the Westerham Hill Park Estate. He denied that the River Darenth would be seriously affected, nor could he admit that the inhabitants of the Cray Valley should be apprehensive that abstraction of water would prove injurious to them.

In cross-examination by Lord R. CECIL, witness said the names in the list purporting to be of members of the Kent Water Preservation Association comprised a number of landowners, mill owners, and manufacturers. He should not, however, call it an important list. He denied that the flow of the River Cray had been substantially decreased by the sinking of the Orpington well. No doubt the flow of the river had diminished; but that was to be attributed to the unprecedented drought over a long series of years. The water level had shrunk throughout the country. He could not say that the water in the streams was hard, or that it was the overflow from the natural reservoir on the top of the chalk. The works of the Company did not abstract the spring water, to the best of his belief, seeing that they were pumping at a lower level. If the Company had 36 gallons of water per head per day for their consumers up to 1905, it could not be taken that they had all the capital powers that they required. They must have more water than was required for the actual daily supply. It would be impossible to carry on water-works without a margin of reserve. They had to provide for a break-down of machinery and so forth.

Dr. *H. R. Mill* gave evidence as to the average rainfall in the Orpington district in several periods prior to 1900. The eighteen years rainfall previous to 1883 had been 112 per cent. of the mean average as shown by records, or 12 per cent. in excess; whereas in the eighteen years from 1883 to 1900—the dryest eighteen years on record—the rainfall was only 92 per cent. of the mean average, showing a deficiency of 8 per cent. These variations were quite sufficient to account for the very large diminution in the volume of the River Cray in the last twenty years.

Mr. *W. Whitaker*, F.R.S., said he undertook an examination of the springs in the county of Kent for the Royal Commission on the Metropolitan Water Supply in 1892. The question of the falling of the level of saturation in the chalk was not altogether a simple matter, but was sometimes very difficult indeed to determine the causes of. The decrease in the outflow of springs was very general. It had occurred in late years in parts where it was difficult to understand, and where there was no artificial interference or pumping; and the general decrease was undoubtedly attributable to the long period of low rainfall. In this case, there were other reasons besides the dryness. There were considerable wells in the chalk, supplying small towns and large manufacturers; and the total amount taken by such wells would be very considerable. The River Darenth was not purely a chalk stream, but derived its water very largely from the greensand; and any decrease in the waters in the sand would lessen the volume of the river. The Ravensbourne was partly a chalk stream, but got much of its water from the tertiary beds. The pumping of the Company only affected the chalk part of the sources of the Darenth or Ravensbourne. The Company's water supplied Kent; hardly any of it going outside, except where another Water Company like the East London were in straits, and were helped over their difficulties. He would not say the pumping of the Company had no effect on the streams; he allowed it must have some effect, but thought that the dryness of the seasons had a very much greater effect.

In cross-examination, witness said the distance round the wells affected by the pumping would vary. Questioned as to whether he agreed with Professor Boyd Dawkins that 1,100,000 gallons a day might be taken without injury to the locality from the Cray basin, witness said he thought there must be some mistake.

Thursday, June 12.

On the resumption of the proceedings to-day,

The CHAIRMAN wished to know whether the works proposed under the Bill were to be taken as enhancing the value of the undertaking in the event of the sale to the Water Board.

Mr. *Dickson*, recalled, said the point was covered by clause 20 of the Bill. There would be an arbitration in the event of purchase; and if the capital account were overdrawn the overdraught would have to be considered.

The CHAIRMAN: Then the value of your Company would be enhanced by the addition of the £150,000 capital you seek to raise by the Bill?

Witness: No; because clause 20 cuts off any such enhancement.

Mr. COWARD said that clause 20 had been discussed with the London ounty Council, and a settlement had been arrived at. The clause set forth that nothing in the Bill should authorize the Company to bring into account, or make any claim in respect of, any advantages that might accrue under the Bill, provided that, in the event of purchase, the Company might bring into account the actual amount of any capital expenditure under the Bill. If the £150,000 was spent on urgent and pressing works, the Company would be entitled to bring it into account; but there would be no enhancement of the value of the undertaking by reason of this measure. Counsel went on to say that Lord R. Cecil had put in a long list of names of petitioners, and also a map. It would be advantageous if it could be pointed out on the map the nearest point to the Westerham station at which it was alleged these gentlemen would be prejudiced by the Bill. The only question now was as to this Westerham station.

Lord R. CECIL said he should be glad to meet his learned friend in every way he could. A number of the gentlemen on the list referred to would be called to give evidence. He could not admit that the only question was as to the Westerham station. The promoters proposed to spend money in other places; and the effect might be the further depletion of the water courses of the district.

Witness, in further examination, said that provision ought to be made to supply the population of the County with 43 gallons of water per head per day. He also pointed out that sewage purposes as well as drought had led to the fall of the level of the water courses in the district in recent years.

In cross-examination by Lord R. CECIL, witness said it would not be difficult to insert a clause in the Bill limiting the amount of water to be taken by the Company.

Mr. *E. M. Eaton* was the next witness called. He said the well at Westerham Hill was in the outcrop of the chalk, and it would not be possible to obtain from it a large quantity of water to send into London. Only enough could be got for local purposes. The Company's supplies were largely increasing; and additional works were now earnestly required; and had been required for some time. The amount asked for—£150,000—was a remarkably insignificant sum in proportion to the size of the undertaking. He did not dispute that the flow of the Rivers Cray and Darenth had decreased of late years; but he did not attribute this to the pumping of the Company. As a matter of fact, the plane of saturation in the chalk had dropped. Therefore, the plane of the water was at a much lower level than it was years ago. As showing that this was not due to pumping, he pointed out that the same condition of things prevailed in other chalk formations of the country where no pumping operations were carried on. The rainfall during the past seven years had been far below the average. There had been a loss of 30¾ inches, or equal to a year's rainfall. There had been a deficiency in the fall for the past eighteen years.

In cross-examination, witness admitted that pumping accelerated the fall of the plane of saturation in the chalk.

Mr. *A. Williams* gave evidence to show that there had been a decrease in the flow of water in streams throughout the country during recent years. This had occurred in such rivers as the Wharfe, the Tweed, the Derwent, the Ribble, the Ure, and other streams in Wales and England.

This closed the case for the Bill.

Mr. *Clayton Beadle*, Consulting Chemist to Messrs. Joynson, of St. Mary Cray, and Secretary to the Kent Water Preservation Association, examined by Mr. CLARKE WILLIAMS, gave evidence to the effect that the flow of water in the River Cray during the past fifteen or sixteen years had been steadily diminishing. He attributed this to the excessive pumping of the Kent Water Company at Orpington and Crayford. A spring in the neighbourhood had completely dried up. Attention had been called to this Bill by the proceedings in the House of Commons; and a meeting of land and mill owners and inhabitants of the Cray district had taken place at the Cannon Street Hotel, and an Association was formed to protect the water in Kent. He pointed out that the water in the local streams had become depleted, and that his Company, who had formerly used a 40-horse power water-wheel, were no longer able to obtain water power.

In cross-examination by Mr. LITTLER, witness said his firm were suffering a loss of from 30 to 40 horse power continuously. They had given up water power because there was no water there.

Mr. LITTLER: Then what harm can this Bill do? Will a single person be injured?

Witness: I think the millowners of Horton-Kirby will be.

Lord R. CECIL (interposing): If you will give us an undertaking not to sink further wells, we shall be satisfied.

Mr. LITTLER: I do not intend to give anything to anybody who has no right to it. An opposition that wants to deprive the people of their drinking water is not one I am going to favour unless your Lordships say I must. (To witness:) Do not you think that more water may be wanted for a population increasing at the rate of 10,000 a year?

Witness: Possibly it may be.

You are complaining of what has happened in the past?—What has happened has reduced the water in the rivers.

What do you object to in the Bill?—The power which will enable you to sink additional wells at Crayford.

Mr. *Richard Berens*, Chairman of the Kent Water Preservation Association, gave evidence as to the drying up of water courses and wells in the county in recent years. As a property owner, he himself had suffered though this depletion. He had noticed a great change for the worse since the Orpington pumping-station began to work in 1880. All the small wells in the neighbourhood had dried up.

Mr. *Fearnley*, connected with the firm of Messrs. Joynson, paper-mill owners, of St. Mary Cray, said that water power had ceased to be available at their mills. They had no definite record of when the flow of the river commenced to diminish; but they had abandoned their water-wheel twelve or thirteen years ago. They attributed the falling off in the volume of water to the operations of the pumping-stations.

Mr. *H. E. Gilman* said that the water courses in his neighbourhood had been depleted by the pumping-station at Wilmington. He knew that the pumping-station affected the stream, because at one time when the pumps were stopped owing to a breakdown, the water in the stream rose to its old level. Four wells on his property, as well as watercress beds, had been dried up.

Captain *R. A. Vansittart* also spoke of a diminution in the volume of water coming down the river from Foots Cray during recent years. He did not think his property on which the wells had dried up was more than two-and-a-half miles from the nearest pumping-station. If in his district they had taken action against the Water Company some years ago, they would not have lost their water as they had done.

Mr. *T. A. Nash*, owner of paper-mills at St. Pauls Cray, said that before 1880 they had from 7 to 8 million gallons of water flowing down the River Cray per day; and his firm used water power. Since then, however, there had been a gradual diminution in the volume of the river. There was now no water at the river head.

Mr. *William May* objected to the spending of money on works which would further deplete the water in the local streams. He did not think the promoters wanted further water. In his opinion, the bulk of the water which was to be obtained by this Bill would be disposed of in the part of the Company's district in the County of London.

Mr. *Urban Smith* said he was acquainted with the watershed in question, and to his mind the effect of spending more money on pumping-stations would undoubtedly be to abstract more water from the underground soil. The Company could supply 30 gallons of water per head of the population per day and still have a margin of 10 gallons per head for emergencies. If necessary, more water than was got at present could be pumped from some of the wells; and besides this the Company had reservoirs. The deficiency in the rainfall during recent years was not sufficient to account for the failure of the water in the River Cray. He should like very much to limit the pumping from the wells in all the higher parts of the county. If they were restricted to the supply of the immediate neighbourhood, it would limit the damage. He thought compensation should be given to the people of the district before any more water was taken from them, particularly seeing that the sites of the wells had not been selected with due regard to the wishes of the inhabitants. The Company ought also to be restricted from sinking new wells without express powers from Parliament.

In cross-examination by Mr. COWARD, witness said undoubtedly it was necessary to have increasing mains and pipes; but the 30-inch main proposed was not at all necessary—it was a larger one than had ever been put down by the Company. As to the shortage of rain, it depended very much on how one picked the years. During the past five years, the Greenwich average rainfall was 21·68 inches, and the mean average for the last forty years 23·89 inches, or a difference of about 2 inches. If a period of heavy rainfall were taken, one would get a greater difference; but that would not be a fair way of proceeding. From his own experience, where pumping operations were going on, the dryness of the streams was very much greater than where there was no pumping. Even Mr. Eaton had admitted so much. What he suggested was that the wells in the north part of the district near the Thames, which could be pumped without doing so much damage as the pumping of the upper wells did, should be more utilized, and the upper wells restricted. In regard to compensation to landowners, he thought that if water companies placed their wells where they did damage, then if people suffered from these badly placed wells they should be compensated. He believed there was a precedent for that in the case of the St. Alban's Water Company who desired to put a pumping-station near a stream on which Lord Verulam had some mills. The Kent Company made a large profit; and he did not see why, if they damaged private people, they should not compensate them.

Mr. *M. Hennell* said he was acquainted with the Kent Company's district. He had observed the depreciation of the River Cray since the establishment of the Orpington pumping-station. This was the first time the voice of mill and land owners had been heard before Parliament. The Company could take 27½ million gallons per day; and though this might not be quite sufficient, he did not think they wanted much more. There were places in the district where water might be taken without doing any damage to landowners—from Plumstead to Crayford, and the greensand area.

In cross-examination, witness said he did not know that a million gallons less per diem was now being pumped at Orpington than in 1895.

Friday, June 13.

At the commencement of the proceedings to-day,

Mr. LITTLER said he was anxious that the Committee should know what the position of the Local Government Board was in regard to the proposals of the Bill, and if they would indicate, through their Clerk, that they desired to hear from the Department what their view was, it would assist the Committee in arriving at a conclusion.

The CHAIRMAN: Would they send us in a report?

Mr. LITTLER: What I would suggest is that some one who understands the matter should come from the Local Government Board to answer questions.

The CHAIRMAN: The works at Westerham have been commenced, have they not?

Mr. LITTLER: They were purchased seven years ago, and we are pumping 250,000 gallons of water per day there.

The CHAIRMAN: There was not a Special Act for it?

Mr. LITTLER: No; but we have absolute authority there. We bought the wells from the owners of the property.

Lord R. CECIL (to Mr. Littler): Why are you coming here now?

Mr. LITTLER: Because so many people are attacking the Water Companies that we think it desirable to be on the right side. We seek parliamentary powers for the Tatsfield portion of our works, at the request of the local occupiers.

The CHAIRMAN: We have asked the Local Government Board to attend.

Mr. *Strachan* was then called. He said that, generally speaking, he agreed with the evidence of Mr. Urban Smith. As to the question of rainfall, which he had carefully studied, he believed that there had been a deficiency of 2¼ inches per annum during the past seven years. That must have had some effect in reducing the streams; but the pumping of the Company had aggravated the deficiency very seriously. The deficiency altogether was about 4½ inches per annum.

Witness was asked questions as to the desirability of compensating the landowners for the abstraction of water.

Mr. LITTLER objected to special protection being asked for, as the question was not raised in the petition.

After some discussion,

The CHAIRMAN said the Committee were of opinion that the question of compensation could not be gone into.

Mr. *Dickson* was recalled at the request of Lord R. CECIL, and said the Company were drawing a million gallons of water less from their Orpington wells than they formerly drew.

Mr. *Lithiby*, Assistant Secretary to the Local Government Board, in reply to Mr. LITTLER, said that an official of the Department had waited upon the Kent Water Company in regard to the present Bill, and had taken exception to the amount of capital asked for—viz., £300,000 for five years. This was reduced to £150,000 for two years. The reduction met the objection of the Local Government Board.

In cross-examination, witness said the Local Government Board were anxious to restrict the Company to applying their new capital to the purposes named in the Bill and their other capital purposes. They desired that the Committee should be aware of the existence of the Government Bill for the purchase of the Water Companies, and that the Committee should be satisfied that the works proposed were necessary. They did not go into the question as to whether or not the Company were doing injury to local landowners.

Lord R. CECIL then addressed the Committee for the petitioners. He said that unquestionably the depletion of the waters of the Rivers Cray and Darenth, and the substantial lowering of the water level in this portion of Kent, had been very detrimental to the county. Though this falling off in the water supply might be attributable in a measure to deficiency of rainfall, yet the deficiency had begun to be felt before the period of drought commenced. In fact, it had been practically admitted by witnesses for the Bill that the pumping operations of the Company in the district had seriously affected the wells and springs. If, however, it had been established to the satisfaction of the Committee that the powers of the Bill were necessary to enable the Company to cary out their obligations to the water consumers, he would not ask for its rejection; but what he would ask was that the Company should not be permitted to make any new draught upon the underground waters of the district without the express sanction of Parliament. In regard to the well to be sunk on the Westerham Hill Park Estate, he would also ask the Committee to limit the amount of water to be taken, and to forbid the Company to pump water there except for the supply of that district.

Mr. LITTLER then replied for the Company. He said the capital now asked for was to cover the cost of works actually in progress, and which were absolutely necessary if they were to carry out satisfactorily their duties to the consumers.

The CHAIRMAN said the Committee passed the preamble of the Bill; but they desired the insertion of a clause somewhat to the following effect: "Particulars and estimates of the improvements, extensions, and expenses contemplated in the Company's undertaking to be furnished and placed as an appendix to the Bill, so as to prevent or prohibit the application of any portion of the new capital of £150,000 to any purpose other than the completion of the works and wells already authorized by Parliament, which could not be postponed and were necessary to the proper distribution by the Company of water to their consumers."

Mr. LITTLER undertook to submit a clause.

The Committee refused a clause brought up by Mr. Clarke Williams to limit the supply of water taken from the Westerham well to such parts of Tatsfield as might be within the extended limits of supply as defined by the Act.

Monday, June 16.

The Committee sat to-day for the purpose of considering clauses.

Mr. LITTLER said that, in consequence of their Lordships' decision, it was proposed to add the following to the preamble of the Bill: "And whereas the estimated capital expenditure in connection with such works and mains now in progress and actually ordered from the 12th of March, 1902, to the 31st of December, 1903, is set forth in the schedule to this Act." Then they proposed the addition of a new clause (13) so as to explicitly show the allocation of the new capital. This clause was as follows:—

The moneys raised under the powers of this Act, and any premiums which may be obtained on the sale of stock under this Act, shall be applicable if not exceeding the undermentioned respective amounts, to the undermentioned purposes, but only so far as such purposes may be of a nature or character to which capital is properly applicable—that is to say: For, and in connection with, the 30-inch main from Wilmington to Bridgen, the 30-inch main from Bridgen to Deptford, new mains to Darenth and Green Street Green, and the 14-inch main Overy Street to West Hill, Dartford, and ordinary district mains, the several sums set against those works respectively in the schedule to this Act amounting together to £97,053; for the enlarging and improving of, and for adits and tunnels and other works in connection with, the pumping stations now in course of construction at Darenth, Crayford (Wansunt), Overy Street, and Westerham Hill, and additional engine power and machinery in connection therewith, the several sums set opposite those respective works in the said schedule amounting together to £36,630; for, and in connection with, the Shooter's Hill water-power and the Bickley reservoir, now in course of construction or completion, £17,000; and contingencies, 10 per cent. in connection with the above works, £15,068—£165,751 in all. Or so much of those sums, respectively, as will remain outstanding after giving credit for payments made on account thereof since the 12th of March, 1902, and in payment of the costs, charges, and expenses of, and incident to, the preparing for, obtaining, and passing of this Act, and to any other purposes of the Company to which capital is properly applicable.

Then they gave the schedule, which set forth in detail the cost o every work exactly in accordance with the statement made by Mr. Dickson in his re-examination. The amount to be spent on works was £146,564. The promoters only asked for £150,000. In addition to the details given in the schedule, there were the costs of the Act to be provided for. Any surplus which might accrue over and above all

these payments would be applied to outstanding bills. He did not expect there would be much margin when everything was paid.

The CHAIRMAN: Have you not inserted the words of the clause we proposed?

Mr. LITTLER replied in the negative. He had rather gathered from their Lordships that all they wanted him to do was to put their decision into technical language, and they had done that.

Lord R. CECIL said the Committee had said that the Bill should provide against capital being spent on works and wells other than those already authorized by Parliament. He contended that the new clause proposed would not prevent or prohibit the application of capital which might not be required for a scheduled purpose to the general works of the Company. They might spend less on some works and more on others. He would suggest, to prevent this, that at the end of the new clause, after "passing of this Act," the words "and to no other purposes of the Company" should be inserted, leaving out the words "to which capital is properly applicable." This would confine the promoters to expenditure on the purposes indicated by their Lordships. He would also propose the addition of the following new clause: "The Company shall, in furnishing their annual statement of accounts under the Metropolis Water Act, 1871, specify the amount raised and expended under this Act."

Mr. LITTLER said all the works scheduled were shown to be urgently needed. If they were limited as proposed, they might be prevented from ordering a new stop-cock, should their capital be exhausted. It would be some time before the new authority would be able to take over the undertaking. As to the £3000 they had in hand, it might be all swallowed up by a break-down of machinery.

The CHAIRMAN: Unless you want to go outside our decision, I fail to see what objection you can have to the amendment proposed by Lord R. Cecil.

Mr. LITTLER said that if the promoters were limited in the way proposed, he would ask the Committee to strike out of the Bill the provision requiring them to supply the Tatsfield district.

Lord R. CECIL said it was an outrage that Tatsfield should have been omitted from the estimate.

After further discussion,

The CHAIRMAN said he looked upon this Tatsfield district as new matter brought before the Committee to day. If the £150,000 had not been considered sufficient, more money should have been asked for.

Mr. LITTLER said the promoters were tied down in their expenditure. If the Committee desired, they could amend the schedule and include among the objects for which the money was authorized to be raised the works at Tatsfield.

The Committee having deliberated in private,

The CHAIRMAN said they had decided to adopt the amendment indicated by Lord R. Cecil.

LEGAL INTELLIGENCE.

Interference with Ancient Lights.

At the Devonshire Assizes, at Exeter, last week, before Mr. Justice Bigham, Mrs. Ann Stark sought to restrain the Torquay Gas Company from completing a building which she alleged interfered with her ancient lights. Lord Coleridge, K.C., and Mr. Clavell Salter appeared in support of the plaintiff's case; Mr. Foote, K.C., and Mr. Berkeley represented the Company. The Company are extending their works, and in so doing they are erecting the building in question, which was in the neighbourhood of Swan Street, some property adjacent thereto being owned by the plaintiff. When the operations commenced, she wrote to the Company complaining that the lights of her cottages were being interfered with, and threatening proceedings. The Company endeavoured to meet her by an offer of compensation; but they declined to give the £3000 which she asked for property of the annual value of only £30. In the course of plaintiff's case, his Lordship said he should decline to make an order upon the Company to pull down their building, and he suggested that the matter was eminently one for damages. Eventually Lord Coleridge announced that the parties had come to terms; the plaintiff having agreed to accept £50 as compensation and £250 costs. The learned Judge said the Company had acted very properly in the matter. They were erecting a building which was for the public use, and it would be monstrous to ask that it should be demolished because there was interference—he believed it was slight—with the plaintiff's lights.

Incorrectly Filling-in a Time Sheet.

At Birmingham, last Tuesday, a young man named E. B. Twigg was charged by the Gas Department with obtaining 2s. 3d. on May 9 with intent to defraud. The defendant was a fitter; and on May 7 he went to work in Sutton Coldfield. In filling up his time-sheet for the day, he showed that he had worked from 8 o'clock in the morning until 9.15 at night; but from inquiries which had been made, it was found that he finished his work shortly after 6 o'clock. His time-sheet was handed to the clerks in the usual way; and on pay-day Twigg received 2s. 3½d. in excess of what he had actually earned. In the course of the evidence, the Superintendent of the Fitting Department admitted that he had endorsed the defendant's time-sheet, "Overcharged; 3¼ hours to be stopped." He did not treat it as a matter of account, but as a crime, and discharged the defendant. Mr. Arthur Chamberlain (the Chairman of the Bench of Magistrates) said he did not see the necessity for bringing the man before the Court. To discharge him and to keep back the money he had sought to improperly obtain, was a right method; but employers did not bring their workpeople into Court every time they took a few shillings. If they did, many more magistrates would be required. The case would consequently be dismissed.

MISCELLANEOUS NEWS.

THE BOARD OF TRADE AND PROVISIONAL ORDERS.

Dispensing with Consent of Local Authorities.

Our readers are aware that the Board of Trade have power, under section 4 of the Gas and Water Works Facilities Act, 1870, to dispense with the consent of a local authority to an application by a gas or water company for a Provisional Order, where they consider this is not called for; but they have to specially report to the House of Commons on the matter. Three of these reports have recently been presented, relating respectively to the Bothwell and Uddingston, Clay Cross, and Hornsey Orders.

The first-named application for the Order was made by the Bothwell and Uddingston Gas Company, Limited, and it was for power to maintain, continue, and construct gas-works on an existing site, and to manufacture and supply gas within part of the parish of Bothwell. Having failed to obtain the consent of the Bothwell Parish Council, the promoters asked the Board of Trade to exercise the powers conferred upon them of dispensing therewith. The Board accordingly held an inquiry at their office, at which representatives of the Lanarkshire County Council, the Middle Ward District Committee of that Council, and the Bothwell Parish Council attended. It appeared that the consent of the Lanarkshire County Council and the Middle Ward District Committee had been given to the Order, and that these authorities were desirous that it should be granted. The consent of the Parish Council was withheld, for the reason that they considered it undesirable that statutory powers should be given to a private Company. It did not appear to the Board of Trade that there was any ground for refusing to grant the powers asked for, and they decided to dispense with the consent of the Parish Council and to grant the Order, subject, however, to certain modifications and amendments.

In the case of the second Order, application was made by Messrs. William Jackson and Thomas Hughes Jackson, carrying on business as the Clay Cross Company, for authority to maintain and continue their existing gas works at Clay Cross and Morton, in Derbyshire, construct further works, and define and extend their area of supply. All the necessary consents were obtained with the exception of that of the Shirland and Higham Parish Council; and the promoters asked that it might be dispensed with. The Board of Trade accordingly held an inquiry, at which representatives of the Shirland and Higham Parish Council attended. The promoters were already supplying gas to the village of Stonebroom, in the parish of Shirland and Higham; but it was proposed to include within the limits a portion of the parish not already supplied by them. The representatives of the Parish Council offered no objection to this, but urged that the maximum price of gas as proposed in the Draft Order should be reduced. It did not appear to the Board that there was any ground for refusing to grant the powers asked for as regards the portions of the parish of Shirland and Higham included in the proposed limits of supply; and therefore they decided to grant the Order, subject, however, to a reduction in the proposed maximum price of gas, as well as to other modifications and amendments.

With respect to the Hornsey Order, the application was made by the Hornsey Gas Company, and it was for power to construct additional gas-works on an extension of their existing site, and to raise further capital. Having failed to obtain the consent of the Wood Green Urban District Council, the promoters applied to the Board of Trade to have it dispensed with. The Board thereupon appointed Mr. Ingram B. Walker to hold a public inquiry at Hornsey, and to report to them in the matter. As the result, he recommended that the Order should be granted on the following conditions: (1) The additional share capital to be limited to £160,000, with borrowing powers not to exceed one-fourth of that amount. (2) No retort or other works used for the manufacture or purification of gas, or for the manufacture or storage of coke or other residual products obtained, to be erected on the new scheduled lands within a distance of 170 feet westward from the eastern boundary formed by the River Moselle and a certain house (specified) in Brook Road. (3) The Moselle to be culverted through the Company's works, subject to the consent, if necessary, of the riparian owners, so far as it skirts the Company's property used by them for the purposes of their gas-works. (4) A clause to be inserted to carry out an agreement with the District Council as to pressure. (5) The Company to be restricted from using the new scheduled lands for the conversion or manufacture of residual products. After considering Mr. Walker's report, the Board decided to dispense with the consent of the Local Authority, and to grant the Order, subject to the suggested modifications and amendments.

THE CORPORATION OF LONDON AND THE PRICE OF GAS.

The Town Clerk of London (Mr. James Bell) has communicated to the Public Control Committee of the London County Council the decision of the Corporation to co-operate with them in promoting a Bill "to secure a substantial reduction in the price of gas supplied by the Gaslight and Coke Company north of the Thames, and for the redress of other grievances," as recorded in the "JOURNAL" for the 17th ult. (p. 1696). The association of the Corporation with the Council in this matter is subject to the following resolutions, passed at the conference held at the Guildhall on Oct. 31, 1900, and approved by the Corporation on the 29th of the following month, not being departed from without the previous consent of the Corporation: (1) "That in the opinion of this conference the Gaslight and Coke Company are not justified in charging more per 1000 feet for gas supplied

on the north side of the Thames than is charged by themselves and the South Metropolitan Gas Company for gas supplied on the south side; and that the Gas Companies of the Metropolis working under the sliding-scale should not be allowed to charge more per 1000 feet for gas supplied than the lowest price at which it is supplied by any one of them, so that gas consumers should not be compelled, as under the present monopoly, to make good the loss incurred by bad management." (2) "That the advantages secured to the Local Authorities on the north side of the Thames by the City of London Gas Act of 1868, and the Amalgamation Scheme of 1883, as to the supply of gas for public purposes, should not be interfered with." A copy of the letter has been forwarded to the Parliamentary Committee of the Council.

LEEDS CORPORATION GAS SUPPLY.

A Deficit on the Past Year's Working.

According to the accounts of the Leeds Corporation Gas Department which were presented by the City Accountant (Mr. W. Derry) to the Gas Committee last Tuesday, the result of the year's trading is a net profit of £10,781; but after deducting £13,079 for sinking fund purposes, there remains a deficiency of £2298. Besides, in accordance with a resolution of the City Council, certain sums were taken from the reserve fund during the year to meet additional expenses in repairs and renewals of works. It appears that several things have operated to produce a not very favourable balance-sheet. The Committee were called upon to pay £7941 more for coal than in 1900-1; while the income from the sale of residuals was less by £26,817—coke alone, owing to falling prices, being responsible for £23,570. The quantity of gas sold per ton of coal carbonized (exclusive of that used on the works) was the largest on record—viz., 9430 cubic feet—an increase over the previous year of 443 cubic feet, equal to 4·9 per cent. This is shown by the fact that, though 10,084 tons less coal were used, 42,604,802 cubic feet more gas were sold; representing a saving of about £10,000 for the year.

LANCASTER GAS AND WATER SUPPLY.

The annual report of Mr. Charles Armitage, the Gas Engineer and Manager to the Lancaster Corporation, states that the total receipts of his department for the year ending March 25, including bank interest, amounted to £30,545, and the expenditure to £22,878, leaving a gross profit of £7667, which amount, under the heading "net revenue account," is divided up as follows: Interest on stock and mortgages, £3791; redemption fund, £1605; income-tax, £595; borough fund, £1250; and reserve fund, £425. The reserve fund now amounts to £12,370. The £1605 added to the redemption fund during the year makes the total, with interest accrued, £19,328. Nothing was added to capital account during the year; but the sum of £2850, the cost of new mains, services, meters, and prepayment stoves, has been charged direct to revenue account. The receipts for gas by ordinary meters amounted to £16,794, or an increase of £45. Prepayment meters still retain their popularity, 2109 having been fixed up to date. The receipts from these meters amounted to £3056, or an increase of £762. The returns from public lamps show an increase of £134. The apportionment of the average price received per 1000 cubic feet of gas sold is as follows: Net cost of gas, 1s. 4·79d.; new mains, services, meters, and prepayment stoves, 4·13d.; interest on stocks and mortgages, less interest from banking company, 5·23d.; redemption fund, 2 33d.; to borough fund, 1·81d.; reserve fund, 0·61d.; average price received, 2s. 6·90d. The average cost of coal has been 14s. 10·26d. per ton, as against 15s. 9·88d. in the preceding year. Coke has contributed in return 5s. 8·35d., and products from tar and ammoniacal liquor 3s. 10·53d.—making a return for residual products of 9s. 6·88d. per ton of coal carbonized, or 64·44 per cent. of the cost of coal. Products on the whole have not increased in price since Mr. Armitage's last report. The working statement shows that the total quantity of gas sold during the last twelve months was 165,516,032 cubic feet, an increase of 4,035,375 cubic feet (2·5 per cent.).

The income of the Water Department for the twelve months ending at the same date exceeded that of the previous year by £1121, while the total expenditure was less by £876. The net profit for the year is £5152, or £2011 more than for the previous twelve months.

COVENTRY CORPORATION GAS UNDERTAKING.

The Annual Report.

The annual report of the Gas Committee of the Coventry Corporation states that the total revenue for the past year from all sources, including sales of gas and residual products, amounted to £90,273; while the expenditure was £77,146. This left a gross profit of £13,127, to which had to be added the amount carried forward from the previous year £329, and the interest allowed by the bank £989, making a total of £14,446. Against this had to be placed capital charges amounting to £11,986, leaving a balance of £2459. The Committee recommended that £2000 of this sum should be carried to the reserve fund (making the total of the fund £7129), and the balance carried forward to the next accounts. The amounts expended during the year on capital account were as follows: Lands acquired (on the Foleshill site) £328; structural works (Foleshill site), £4085; new mains and services, £1560; new meters, £1009—total, £7022. The borrowing powers exercised since the acquisition of the gas undertaking amount, with nominal additions, to £308,992, of which £31,340 has been repaid out of the sinking fund, and £10,336 (3 per cent. mortgages) has been paid off and not yet re-borrowed. The present liabilities are therefore £267,316. Against this, the Corporation have reserve and sinking funds amounting to £14,281; leaving a balance of liability of £253,035. The total capital expended since the acquisition of the undertaking, including the original purchase money, amounts to £245,544, and the balance of capital in hand is £53,112.

THE GAS SUPPLY OF LEYDEN, HOLLAND.

The Working in 1901.

We have received a copy of the report for the year 1901 of the position and working of the Municipal Gas Works of Leyden, Holland, from which we have abstracted the following particulars.

The works, which are under the management of Heer N. W. van Doesburgh, comprised nineteen settings, with 8 retorts in each, making 152 in all. In the second half of June, 56 retorts were at work, and 136 in December. Various repairs and renewals have been made to the retorts, generators, scrubbers, &c. An additional purifying-house has been built; and a new tar-pump and a coke-breaker have been installed. The total length of mains on the 31st of December, 1901, was 39 miles, including about 2¾ miles laid in the year. The mains are mostly 3 inches in diameter, a few being 4, 5, and 6 inches. During the year, 23,277 (metric) tons of coal were received, at a cost of 17s. 2d. per (metric) ton, against 17s. 1d. in the preceding year. The gas produced in the twelve months was 244,114,255 cubic feet; being an increase of 4 per cent. The maximum increase was in July. Up to the 1st of April, the price of gas was 2s. 7d. per 1000 cubic feet when supplied through ordinary, and 3s. 0¾d. through prepayment meters. After the 1st of April, these prices were reduced to 2s. 4¼d. and 2s. 10d. respectively. The number of ordinary meters in use on December 31 was 4558; it having increased by 183 during the year. The number of prepayment meters was 1915, having increased by 296. Of the gas supplied to private consumers during the year, 72·54 per cent. was through ordinary, and 10·33 per cent. through prepayment meters. The unaccounted-for gas amounted to 4·56 per cent. The quantity of coke produced amounted to 69·52 per cent. of the weight of coal carbonized; and 20·02 per cent. of it was used for heating the retort-furnaces. About 233,180 gallons of tar were produced; being at the rate of about 9½ gallons per (metric) ton of coal carbonized. The quantity of ammoniacal liquor produced was about 1,900,800 gallons. For the purification of the gas, oxide of iron exclusively was used; the spent oxide being sold. It contained, on an average, 7·9 per cent. of Prussian blue. Tests were made of the illuminating power and the composition of the gas. The calorific value amounted, on an average, to 144 calories per cubic foot. The sulphur in the gas averaged 20½ grains per 100 cubic feet. Sulphuretted hydrogen was never present; and only traces of ammonia were found. The percentage of carbonic acid averaged less than 1·2 volumes per cent. The tests for sulphur and ammonia were made according to the prescriptions of the London Gas Referees. The total number of street-lamps had risen during the year from 1172 to 1221; the latter total including 1012 incandescent burners. The mantles used for the maintenance of the incandescent burners averaged 166 per week. The cost of the gas into the holder was about 1s. 7½d. per 1000 cubic feet. The profit balance on the year's working was 98,103 florins, or about £8175.

LONDON COUNTY COUNCIL AND THE WATER QUESTION.

A Criticism of the Government Bill.

At the Meeting of the London County Council on the 24th ult., the Parliamentary Committee presented the following report on the Government Water Bill:—

The Joint Committee of both Houses of Parliament, presided over by Lord Balfour of Burleigh, appointed to consider the Bill introduced by the Local Government Board, concluded their labours on the 13th of June.

When the case for the Local Government Board was opened by Mr. Fitzgerald, K.C., he intimated that he did not propose to call evidence, except of a formal character, in support of the Bill. However, on a protest from Counsel for the Water Companies, a certain amount of evidence was called; but it can hardly be contended that the Bill was supported by evidence in the ordinary way. Seeing that the most important provisions of the Bill were carried, not by a majority of the Committee but by an equality of votes, it will be necessary to explain to the Council the procedure adopted, so far as we are able to do so.

We understood from the debates which took place in the House of Commons on the second reading, and on the appointment of the Joint Committee, that the question of the constitution of the new Water Authority would be a matter left open for free discussion by the Committee. Mr. Grant Lawson, M.P., the Parliamentary Secretary to the Local Government Board, officially laid down in the House the principles of the Bill to which he asked the House to assent. They were as follows: "First, that a Water Board should be created representative of the whole area of supply; secondly, that the Board should be empowered and required to purchase the undertakings of the Water Companies; and, thirdly, that the terms of purchase, in default of agreement, should be settled by three Arbitrators named in the Bill, acting under the terms of reference specially laid down by the Bill."

It will be seen that the constitution of the authority was thus left quite open. Mr. Long himself stated, when referring to the Committee to be appointed to consider the Bill, "that the Committee should consider in the freest possible manner the numbers of the governing body." It seemed clear that the number of the Board could not be considered in the fullest possible manner unless the constitution of the Board were also open to full and free discussion. Mr. Long also explained that "the procedure governing a Bill of this kind is peculiar. It has to be considered as a Private Bill upstairs and as a Public Bill downstairs." It is, we think, apparent that the Joint Committee themselves understood that the question of the constitution of the Board was referred to them, for they devoted a considerable amount of time to the consideration of the question, and resolved upon radical alterations in the constitution of the proposed authority.

The Local Government Board having stated their case, evidence against the proposal was given on behalf of the Council by Mr. M'Kinnon Wood, Chairman of the Water Committee, the Parliamentary Agent, the Right Hon. G. J. Shaw-Lefevre, and Mr. G. F. Deacon, M.Inst.C.E. During the hearing, certain evidence having been tendered on behalf of the Council in favour of what is known as municipal management upon lines similar to those existing generally throughout the kingdom, as was recommended by Lord Ridley's Committee, Lord Balfour of Burleigh stated that he thought the Committee were precluded from considering the case for municipal management, because "the acceptance on the Bill on second reading in both Houses, certainly in the House of Commons, of a Board, rather precludes the suggestion of this Committee going to set up an authority except an authority in the form of a Board." This was subsequently ruled as the opinion of the Committee.

On the conclusion of the Council's evidence, the matter was considered by the Committee, and the following announcement was made on the 30th of April: "The Committee have, by a majority, decided to delete the representation of the Metropolitan Boroughs from Schedule III.; they also delete the representation of the urban districts and boroughs in the counties of Essex, Kent, Middlesex, and Surrey, other than the borough of West Ham. The promoters are requested to prepare a fresh schedule, on the scheme indicated by this decision, for a Water Board consisting of about 35 members, including the Chairman and Vice-Chairman, but without giving a majority on the Board to the representatives of any one county."

Although this was not the system of management proposed by the Council, and although strong objections exist, in our view, to the creation of a new Water Authority, and to the divorce of this important municipal function from other municipal functions, this decision of the Committee would have disposed of one of the most dangerous features of the Government scheme—namely, the proposed reversal of the existing system of London government. However, at the second meeting of the Committee after this decision, Mr. Fitzgerald, K.C., on behalf of the Government, made the following statement: "This decision of the Committee has been considered by the Government, and has been received by them with profound regret;" and he then intimated that the Government could not accept the proposal for a Board on the lines suggested by the Committee.

Upon this announcement on behalf of the Government, the Chairman stated: "The Committee have resolved by a majority to receive the evidence on behalf of the Metropolitan Boroughs and the urban districts outside the Metropolis, if they think fit to tender it, as to the constitution of the Board." Witnesses were thereupon called from certain Metropolitan Boroughs to state that they wished to have the representation offered them under the Bill, while other witnesses from Metropolitan Boroughs were called and gave evidence against the proposed representation.

After hearing this evidence, the decision of the Committee was announced by the Chairman in the following words: "I have to announce that adherence to the resolution of April 30 has been lost on an equality of votes after a division in the Committee. The precise form of Schedule III. will therefore remain for decision when the Committee reach that point of the Bill."

We may point out, for the information of the Council, that in a Committee of the House of Lords the Chairman has not, as in the House of Commons, a right to a casting vote; but in the case of equality of voting, it is held that "the non-contents have it," and the motion before the Committee is therefore lost. But we are unable to explain why, a resolution having been carried by the Committee by a majority, the motion should have been to "adhere" to that resolution. A motion in such a form would appear to be quite unnecessary. The proper course, we are advised, would be to propose to rescind or amend the resolution. Had this course been taken, the proposition would have been lost on an equality of votes, and the decision of the Committee of the 30th of April would have stood. As it was, a resolution carried by a majority was "not adhered to" on an equality of votes. Whatever may be the effect of this unusual procedure, we cannot see that it is the same thing as rescinding the resolution.

As the result of the above proceedings, we found ourselves in this position: It had been ruled that the Committee could not consider the Council's proposal for municipal management, but only the form and constitution of a Board drawn from the water area; and we were advised that the only way by which the Council could hope to improve the scheme contained in Schedule III. was to propose amendments on the lines of the conditions laid down by the Committee. Accordingly, we put forward two amendments: (*a*) For a Board as proposed by the Government itself in the Bill introduced by Lord James of Hereford in 1896, which was in accordance with the Committee's decision on the 30th of April, in so far as it was based on county representation; and (*b*) for a Board which would have still further carried out the decision of the Committee, inasmuch as it did not give a majority to any one county. The latter proposal was in many ways similar to the Board proposed by Lord Llandaff's Commission.

These amendments were for Boards constituted as follows: (*a*) London County Council, 16; City Corporation, 2; Middlesex County

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 20.

Issue.	Share.	When ex-Dividend.	Dividend on Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	18—19	..	5 10 6
100,000	10	,,	7½	Do. 7 p.c.	13—14	..	5 7 2
300,000	100	Jan. 2	5	Australian 5 p.c. Deb.	100—102	..	4 18 0
200,000	5	May 14	6⅛	Bombay, Ltd.	6—6¼	..	5 0 0
40,000	5	,,	6⅜	Do. New, £4 paid	4⅞—5⅛	..	5 9 5
380,000	Stk.	Feb. 13	12	Brentford Consolidated	255—260	..	4 12 4
270,000	,,	,,	9	Do. New	188—193	..	4 13 3
50,000	,,	,,	5	Do. 5 p.c. Pref.	128—133	..	3 15 2
206,250	,,	June 17	4	Do. 4 p.c. Deb.	111—114	..	3 10 2
220,000	Stk.	Mar. 13	10	Brighton & Hove Orig.	205—210	..	4 15 3
246,320	,,	,,	7	Do. A. Ord. Stk.	148—153	..	4 11 6
420,000	20	Apl. 11	10	British.	39—41	−1	4 17 7
58,000	10	Feb. 13	12	Bromley, Ord. 10 p.c.	23—25	..	4 16 0
82,850	10	,,	9	Do. 7 p.c.	18—20	..	4 10 0
500,000	10	May 14	6	Buenos Ayres (New) Ltd.	9½—10⅛	..	5 14 3
220,000	Stk.	June 24	4	Do. 4 p.c. Deb.	94—96*	..	4 3 4
150,000	20	Mar. 13	8½	Cagliari, Ltd.	21—23	..	7 3 6
100,000	10	June 12	10	Cape Town & Dis., Ltd.	15—16	..	6 5 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	54—56	..	5 7 2
550,000	Stk.	Apl. 11	12	Commercial Old Stock	265—270	..	4 8 11
236,425	,,	,,	9	Do. New do.	205—210	..	4 5 9
238,237	,,	June 12	4½	Do. 4½ p.c. Deb.	130—134	..	3 7 2
800,000	Stk.	May 28	8	Continental Union, Ltd.	138—143	+1	5 11 11
200,000	,,	,,	7	Do. 7 p.c. Pref.	147—152	−3	4 12 1
575,000	Stk.	Feb. 27	5	Crystal Palace Ord. 5 p.c.	120—125	..	4 0 0
60,000	,,	,,	5	Do. 5 p.c. Pref.	122—127	..	3 18 9
91,140	,,	—	5	Do. 5 p.c. Deb. Stk.	140—143	..	3 9 11
486,090	10	Jan. 30	10½	European, Ltd.	18⅜—19⅝	..	5 7 8
354,060	10	,,	10⅝	Do. £7 10s. paid	13⅜—14⅝	..	5 8 8
15,243,200	Stk.	Feb. 13	4 5/16	Gas-light and Coke: Ord.	94—96	..	4 11 8
2,600,000	,,	,,	3⅜	Do. 3½ p.c. max.	90—92	+1	3 16 1
3,799,735	,,	,,	4	Do. 4 p.c. Con. Pref.	111—113	..	3 10 10
4,193,975	,,	June 12	3	Do. 3 p.c. Con. Deb.	91—93	..	3 4 6
70,000	10	Nov. 13	8	Hongkong & China, Ltd.	13—14	..	5 14 4
3,800,000	Stk.	May 14	10	Imperial Continental	202—205	..	4 17 7
473,600	Stk.	Feb. 13	3½	Do. 3½ p.c. Deb. Red.	100—102	..	3 8 8
561,000	Stk.	Feb. 27	10	Liverpool United A	220—222	..	4 10 1
718,100	,,	,,	7	Do. do. B	166—168	..	4 3 4
306,083	,,	June 24	4	Do. do. Deb. Stk.	116—118*	..	3 7 10
75,000	5	June 12	5	Malta & Medn., Ltd.	4⅛—4⅜	..	5 5 3
560,000	100	Apl. 1	5	Met. of Melbourne 5 p.c. Deb.	106—110	..	4 10 11
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	103—105	..	4 5 9
541,920	20	June 12	3⅜	Monte Video, Ltd.	9—10	..	7 0 0
1,595,892	Stk.	Feb. 21	4⅜	Newc'tle & G'tesh'd Con.	105—107	..	4 1 9
346,855	Stk.	Dec. 27	3½	Do. 3½ p.c. Deb.	100—102	..	3 8 8
150,000	5	May 28	8	Oriental, Ltd.	7—7⅛	..	5 6 8
135,000	4½	,,	8	Do.	6—6⅛	..	5 10 9
15,000	1	,,	8	Do.	1⅛—1⅜	..	4 11 5

* Ex div.

Issue.	Share.	When ex-Dividend.	Dividend on Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
60,000	5	Mar. 13	7	Ottoman, Ltd.	6⅛—6⅜	..	5 3 8
851,070	10	Apl. 25	7	River Plate Ord.	10—10¼	..	6 13 4
250,000	Stk.	June 24	4	Do. 4 p.c. Deb.	93—96*	..	4 3 4
250,000	10	Mar. 26	8	San Paulo, Ltd.	12—13	..	6 3 1
135,000	Stk.	Mar. 13	10	Sheffield A	239—241	..	4 3 0
209,984	,,	,,	10	Do. B	238—240	..	4 3 4
523,498	,,	,,	10	Do. C	237—239	..	4 3 8
5,850,000	Stk.	Feb. 13	5	South Met., 4 p.c. Ord.	121—124	−1	4 0 8
1,627,965	,,	Jan. 16	3	Do. 3 p.c. Deb.	93—95	..	3 3 2
380,940	Stk.	May 14	5	Southampton Ord.	102—106	..	4 14 4
70,825	,,	Jan. 16	4	Do. 4 p.c. Deb.	100—103	..	3 17 8
120,000	Stk.	Feb. 27	5½	Tottenham and Edmonton: A. 5 p.c.	120—125	..	4 8 0
260,520	,,	,,	4	Tottenham and Edmonton: B. 3½ p.c.	95—100	..	4 0 0
182,380	10	Jan. 16	5	Tuscan, Ltd.	7—8	..	6 5 0
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	97—100	..	5 0 0
230,000	5	Mar. 13	9	West Ham, 10 p.c.	10—11	..	4 1 10
172,000	10	,,	6	Do. 7 p.c.	13—14	..	4 5 8
				WATER COMPANIES.			
780,599	Stk.	June 24	11⅓	Chelsea, Ord.	300—310*	..	3 14 2
150,000	,,	,,	5	Do. 5 p.c. Pret.	152—157*	..	3 3 8
160,000	,,	,,	4⅔	Do. 4½ p.c. Pref. '75	140—143*	+1½	3 2 11
175,785	,,	Mar. 26	4½	Do. 4½ p.c. Deb.	140—145	..	3 2 1
1,720,560	Stk.	Mar. 26	8	East London, Ord.	213—218	+3	3 13 5
654,740	,,	June 12	4½	Do. 4½ p.c. Deb.	142—147	..	3 1 3
1,018,046	,,	,,	3	Do. 3 p.c. Deb.	96—98	..	3 1 3
700,000	50		8	Grand Junction: 10 p.c. max.	112—117	..	3 8 5
310,000	Stk.	Mar. 26	4	Grand Junction: 4 p.c. Deb.	127—130	..	3 1 7
708,000	Stk.	Feb. 13	16	Kent	290—300	−5	5 6 8
160,000	,,	,,	7	Do. New, 7 p.c. max.	200—210	..	3 6 8
1,043,800	100	June 24	11	Lambeth, 10 p.c. max.	290—300*	..	3 13 4
406,200	100	,,	8⅓	Do. 7⅓ p.c. max.	210—220*	+4⅓	3 17 3
350,000	Stk.	Mar. 26	4	Do. 4 p.c. Deb.	125—130	..	3 1 7
500,000	100	Feb. 13	12 5/10	New River, New Shares	400—410	..	3 2 5
1,000,000	Stk.	Jan. 30	4	Do. 4½ p.c. Deb.	127—132	..	3 0 7
902,300	Stk.	June 12	7	South-wark and Vauxhall: Ord.	188—193	..	3 12 6
126,500	100	,,	7	South-wark and Vauxhall: 7⅓ p.c. max.	180—185	..	3 15 8
489,200	Stk.	,,	5	South-wark and Vauxhall: 5 p.c. Pref.	152—157	..	3 3 8
1,019,585	,,	Apl. 11	4	South-wark and Vauxhall: 4 p.c. A Deb.	125—130	..	3 1 7
1,155,066	Stk.	June 12	10	West Middlesex.	275—285	..	3 10 2
200,000	,,	,,	4⅔	Do. 4½ p.c. Deb.	139—144	..	3 2 6
200,000	,,	Mar. 13	3	Do. 3 p.c. Deb.	95—97	..	3 1 10

* Ex div.

Council, 2; Essex County Council, 2; West Ham Corporation, 2; Hertfordshire, Kent, and Surrey County Councils, and Thames and Lea Conservancy Boards, 1 each—total, 29 members. (*b*) London County Council, 14; City Corporation, 2; Essex County Council, 2; West Ham Corporation, 2; Kent County Council, 3; Middlesex County Council, 4; Surrey County Council, 3; Hertfordshire County Council and Thames and Lea Conservancy Boards, 1 each—total, 33. In each case the numbers would have been increased by the addition of a Chairman and Vice-Chairman to be appointed by the Board. These amendments were, however, negatived—the latter upon an equality of votes.

The Bill as passed by the Committee provides for a Water Board as originally proposed in the schedule, with the addition of four members, and with some slight alterations as regards authorities outside London. The total number of members on the Board, as now provided for, will therefore be (including the Chairman and Vice-Chirman) 73.

We have to call the attention of the Council to the extraordinary circumstances under which this deplorable result has been attained. Schedule III. was condemned on the 30th of April by the Committee, who by a majority carried a resolution reducing the number to about one-half, and deleting the Metropolitan Borough Councils and the Urban District Councils. Under the peculiar circumstances, we may refer to the fact that the Joint Committee was made up of seven adherents of the Government and three members of the Opposition. Yet even strong and open pressure from the Government was not sufficient to secure a majority of the Committee in favour of the schedule. This fact and the vacillation of the Committee justify us in saying that the proposed authority is already discredited.

The final decision of the Committee as regards the third schedule (the constitution of the authority) was arrived at under such circumstances that it was found necessary to make a special report dealing with that matter by itself. That report, as quoted in the public press, is as follows:—

> The Committee, on arriving in due course at the third schedule, went through it, and made various amendments thereto. On the question of passing the schedule as a whole, the Chairman was requested to put the question: "That the schedule stand part of the Bill;" but he gave it as his decision that he should not so put the question, but that, if such a motion were made, he should put the question in the form: "That the schedule be disagreed to." The question having been put, and the numbers being equal, the Chairman (having, in accordance with precedent, no casting vote) ruled that the said schedule must stand part of the Bill, on the principle that no amendment should be made to the Bill as referred to the Committee by the House after second reading unless there should be a majority in favour of such amendment.

We do not propose to repeat the very grave objections to the scheme which we have already laid before the Council, and which were given in evidence before the Joint Committee. The principle involved in this scheme amounts to an absolute reversal of the existing system of London government; and we desire most emphatically to protest against such a principle being established on a side issue, and after having actually been condemned by the Committee to which it was referred.

We are not able at this moment to place a complete report before the Council with regard to the Bill, as we have not had an opportunity of considering many important financial questions arising upon it and reporting thereon to the Council; but we must point out that some of the most valuable objects of purchase and municipal control will not be achieved by the Bill. To give an example, it has always been understood that one result of amalgamating the eight undertakings and placing them under public control would be that the great anomalies and inequalities in the charges made for water, which exist at present, would be replaced by an equalization of water-rates. Lord Llandaff's Commission expressed the view that this would be one of the first problems which the Water Authority would have to face. At the instigation of the City of Westminster, and with the concurrence of the Local Government Board, provisions have been inserted in the Bill which will tie the hands of the Water Board, and stand in the way of any equalization of water-rates. While this will be to the advantage of the City of Westminster and other of the richer districts, it will be very much to the detriment of the poorer districts in the east and south of London. This is an illustration of what may be expected from the parochial system of representation, as compared with the treatment of London as a whole.

The novel provisions as to the deficiency rate, which is to be apportioned upon one basis and levied upon another, will injuriously affect the interests of London ratepayers. The valuation basis upon which the rate is charged is not equal as between London and the outside areas. This is one of the difficulties which arise from adopting the principle of a Water Board for the whole of a vast heterogeneous area comprising the County of London and parts of five other counties. The amendments of the Council, which were intended to mitigate the injustice done to London, were rejected; and under the Bill the burden of the deficiency rate will fall unequally even upon different parts of London, and there will be considerable discrepancies in the charges throughout the area.

If ever there were cases in which it was desirable that there should be full and unfettered discussion before Committees of both Houses of Parliament, so that the effect of the Bill as amended in the Committee of one House could be reconsidered by another Committee, this is surely one of the strongest. This case involves the largest financial, sanitary, and municipal interests, and is in its nature highly complicated. Yet not only are the safeguards deemed necessary in regard to much smaller interests set aside, but the matter was not left to the judgment of the Joint Committee to which it was referred. They were in the first place precluded from even considering that solution of the problem which can claim in its support the whole weight of precedent, and which is justified by practical success all over the country. Only a very partial and one-sided consideration of the question was therefore possible. In the second place, when the Committee, having heard the

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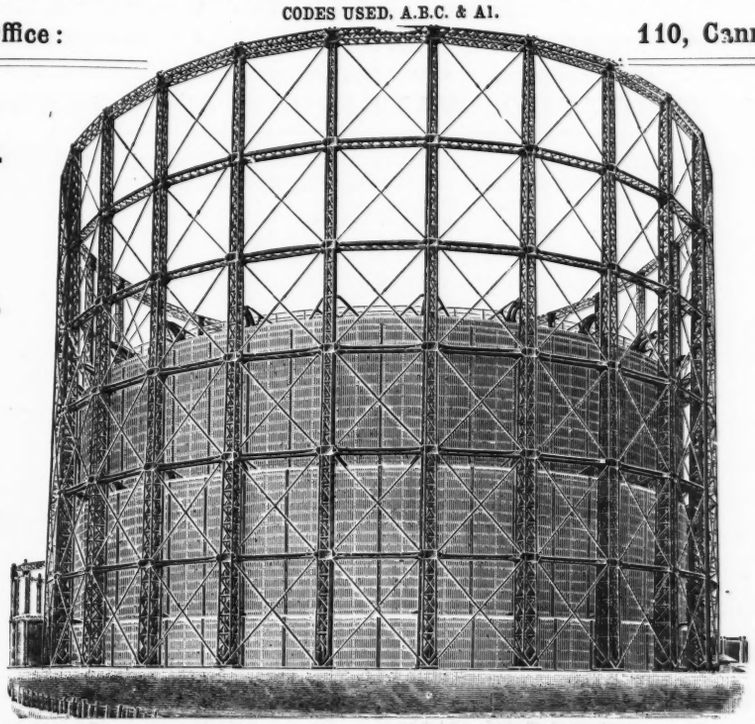

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evidence, came to the conclusion that the scheme should be radically amended, the promoters refused to accept the decision of the tribunal of their own choice. As was pointed out by Mr. Balfour Browne, K.C., the Council is placed in the position of being called upon to plead before one tribunal, and when it succeeds in convincing it, a power behind that tribunal, which has not heard the evidence, sets aside the verdict.

PLYMOUTH CORPORATION WATER-WORKS.

The annual "fyshinge feaste" of the Plymouth Corporation was held last Wednesday week. The customary ceremony of drinking to the memory of Sir Francis Drake, the originator of water-works, was performed at the intake of the storage reservoir at Burrator. At the dinner which followed, the speeches were mainly on other topics than the water-works. Alderman J. T. Bond, the Chairman of the Water Committee, was, in fact, almost the only speaker who had anything to say about the undertaking. In an account of the progress of the past year, he took occasion to eulogize the services of the Water Engineer (Mr. F. Howarth). During the year, 3½ miles of new mains had been laid, and 1½ miles of old mains renewed. The total length of mains was now 170 miles. The meter supplies increased last year from 653 to 898; and in all 768 new connections had been made. The prevention of waste was now receiving the attention of the Water Engineer and his staff. The income for this year was estimated at £27,000, as compared with £25,735 last year. In 1891, when he succeeded to the Chairmanship of the Water Committee, the income was £13,839, so that in twelve years it had nearly doubled. After a reference to the "almost over abundance" of the supply of water at a recent fire in Plymouth, Mr. Bond alluded to a form sent down by the Local Government Board for the Committee to fill up in connection with an application for a loan. The Board required to be supplied with particulars as to the size, weight, and price of iron pipes, and minute details of the other work which the Committee proposed to carry out. It was absurd for the people of Plymouth to suppose that they were governing themselves, when there were officials not under their control who could demand these particulars.

Suffocation by Gas.—A fatal gas poisoning case occurred last Monday week at Glasgow; the victim being an elderly railway messenger named John Borland. On the previous Saturday, Borland took lodgings in George Street, and was not again seen until yesterday morning, when another railway messenger visited the house to ascertain why he had not started work. On opening the door, Borland was found lying undressed on the floor. There was a strong smell of gas in the room.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Many will be the regrets expressed on learning of the tragic death of Professor Ivison Macadam, of Edinburgh, and of the sudden death of Mr. J. C. Adamson, of Airdrie. Professor Macadam was never a gas manager, but he was right-hand man, in many ways, of all gas managers. He never acquired that blindfold expectational devotion towards electricity which is the weakness of many men, even men of great scientific attainments. On the contrary, he was distinguished for holding the balance evenly between the two lights. Probably his chemical connection led him to retain his belief in gas. It is now nearly fifteen years since I first came into contact with him in connection with a gas subject. On that occasion, foreseeing that cooking by gas was coming in, he prepared a paper on the subject, which he read before the Royal Scottish Society of Arts, and which I was permitted to send to the "JOURNAL."* He had studied the subject practically, and was among the first to dispel, in the northern district of the country, at least, the foolish notion that meat was tainted by the fumes of gas while being cooked. In the same paper, he also showed that there was less waste in roasting by a gas-fire than by a coal-fire, and that ordinary burners were more suitable for roasting than bunsen burners. His versatility was remarkable, as will be perceived from the variety of his occupations. The news of his death came to me as a great shock. I saw and spoke to him on Saturday last. He was in command of the Volunteers from the Edinburgh district who attended the Diamond Jubilee celebrations in London, and was to have been similarly in command of the Coronation battalion. It is one of the most melancholy thoughts in connection with his untimely end that he was about to sail for London when the hand of the assassin laid him low; and that on Thursday, at the time which he had doubtless looked forward to as one of the proudest moments of his life, his lifeless remains were being borne to their last resting-place in Portobello Cemetery. It is stated that he wished to proceed to South Africa to fight for his country, but was prevented by his medical adviser. He died in the uniform of the service he loved, but not in face of his nation's foes. A poltroon approached him from behind, and cut him down unawares. A most detestable affair, and one which, in this part of the country, will always be associated with the other most regrettable incident of the great Coronation festival.

Mr. Adamson was a gas manager—at Leven and Galashiels—but left the industry to take a position in the commercial world. It would be useless to speculate upon what he might have become if he had remained a gas manager; it is sufficient to say that he was successful in business, and that he always kept up his connection with his former life work. He must have been early appointed a manager, for he is

* See Vol. XLVIII., p. 791.

CARBURETTED WATER-GAS APPARATUS

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BLACKBURN	1,250,000	YORK	750,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	ROCHESTER	500,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	KINGSTON, ONT.	300,000
COLCHESTER	300,000	CRYSTAL PALACE DISTRICT	2,000,000
BIRKENHEAD	2,250,000	DULUTH, MINN.	300,000
SWINDON (New Swindon Gas Co.)	120,000	CATERHAM	150,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	LEICESTER	2,000,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	ENSCHEDE (HOLLAND)	150,000
HALIFAX	1,000,000	BUENOS AYRES (RIVER PLATE CO.)	700,000
TORONTO	250,000	BURNLEY	1,500,000
OTTAWA	250,000	KINGSTON-ON-THAMES	1,750,000
LINDSAY (Remodelled)	125,000	ACCRINGTON	500,000
MONTREAL	500,000	TONBRIDGE	300,000
TORONTO (Second Contract; Remodelled)	2,000,000	STRETFORD	500,000
BELLEVILLE	250,000	OLDBURY	300,000
OTTAWA (Second Contract)	250,000	TODMORDEN	500,000
BRANTFORD (Remodelled)	200,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
ST. CATHERINES (Remodelled)	250,000	YORK (Second Contract)	750,000
KINGSTON, PA.	125,000	ROCHESTER (Second Contract)	500,000
PETERBOROUGH, ONT.	250,000	NEWPORT (MON.)	250,000
WILKESBARRE, PA.	750,000	TOKIO, JAPAN.	1,000,000
ST. CATHERINES (Second Contract)	250,000	PERNAMBUCO (Brazil)	125,000
BUFFALO, N.Y.	2,000,000	MALTON	150,000
WINNIPEG, MAN.	500,000	DULUTH, MINN. (Second Contract)	300,000
COLCHESTER (Second Contract)	300,000		

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

LEEDS, 1,800,000 Cub. Ft. SMETHWICK, 500,000 Cub. Ft. LEICESTER (2nd Cont.) 1,000,000 Cub. Ft.
GRAVESEND, 300,000 C. Ft. BROCKVILLE (ONT.) 250,000 C. Ft. NEWPORT, MON. (2nd Cont.), 250,000 C. Ft.

said to have been only 62 years of age; and it was in 1861 that he was at the formation of the Waverley Association of Gas Managers at Kelso, which would make him then only 21. And before that he had been at Leven. Probably there is some mistake as to his age; he certainly looked more than 62. It is a pity he was not present at the Kelso meeting of the Waverley Association in April, because he would then have taken his farewell of his brethren of the gas industry in the town where he assisted at the initiation of a movement which has spread over the entire world, and the influence of which upon gas making and selling has been of the most far-reaching kind. The history of the early days of Gas Associations is in a somewhat nebulous condition; and I am unable to say how many of the original members remain with us. I rather think he was the last survivor of the original members of the Waverley Association. He was an original member also of the North British Association, when it was known as the Scottish Association. I think there are two or three of his then colleagues still left with us. It seems as if Mr. Adamson's unique position as the first Secretary of a Gas Association has somewhat fallen out of mind. It is appropriate to recall it now.

It might have been supposed that, having succeeded in his agitation against the management of the Dundee Corporation gas undertaking, the Editor of the "Dundee Courier" would have been content with what honour he could extract from the course he has so persistently followed. But no; his labours are only half done. To him is now the task of educating the Corporation as to what can be done in gas making. Yesterday he treated his readers to an article on the subject, written by a special correspondent—a correspondent who must have been very special indeed, for he was able to give figures "taken from the books of the various works at Berlin," and which "have been carefully checked." So far as they go the figures appear to be very complete.* They purport to give "the cost and process of carbonizing 10,000 tons of coal in the equal time of 17½ days, under the different systems employed," and to be "not only reliable but complete." The number and dimensions of the retorts in the Holzmarktstrasse and the Mariendorf works are given, with the yield per retort per day, per man per day, and per square foot of area of retort-house; the total cost of retort-house labour, the cost per ton per lineal foot of retort and per square foot of area; and the wages of men in the retort-house. To summarize these, it is shown that in the Holzmarktstrasse works, where there are ordinary fire bar furnaces and hand stoking, 267 men are required, and the wages paid per 24 hours amount to £69 19s. 6d.; that in the Mariendorf works, where there are inclined retorts (15 ft. 9 in. by 1 ft. 9 in. by 1 ft. 3 in.), the number of men required is 78, and the wages per 24 hours £20 7s. 3d.; that in the Schöneberg works, where there are both hand stoking and Arrol-Foulis stoking machinery, the former requires 226 men to work the retorts, at a cost per 24 hours of £57 5s. 10d., and the latter requires 166 men, at a cost of £36 12s. 6d.; and that at the Gitschinerstrasse works, where there are inclined retorts, 100 men are required, and the daily wage is £25 4s. 3d. The writer puts in a caveat against his figures being taken as proving everything, because "the relative capital cost of the works has also to be ascertained and reckoned upon." This is very like kicking away the goblet after putting it to our lips. All we can do is to fall back upon the opinion of the writer, which is given quite unhesitatingly, and not only so, but also in a way which the Corporation had better beware of disregarding. They are reminded that they are trustees for the community, and that they are bound to find the most economical system of gas production and to adopt it. "All the information I have got in the city of Berlin," it is opined, "points to the Mariendorf works, with their fine modern machinery and their inclined retorts, as being by far the best of the five systems." Then, the figures "require no elaboration to enrich their eloquence." The logical conclusion to be drawn from the article is that the Corporation of Dundee are bound to adopt inclined retorts. As to the capital account, it has to be "reckoned upon;" but apparently the notion is it should not stand in the way. Now, it is just there where the Corporation have their difficulty. The capital account is already too large. Their error has lain in not reducing it when they had the opportunity, in days when they had it all their own way. Of what value, then, will an article like this be to the Corporation? It will only tend to perplex an already befogged body. It looks enterprising on the part of the newspaper to be thus early in the field with information upon a subject which is occupying the minds of the community; but, in a case like this, half presentation is worse than none at all. The article is, substantially, advising the impossible, and is, therefore, more an addition to the confusion that exists than a clearing up of it.

The annual report of the Directors shows that the Hawick Gas Company have had a very successful year. There is a considerable surplus after providing for the payment of the usual dividend of 10 per cent. Following an exhibition of gas appliances, a very large number of cooking stoves were sold or hired. The Directors have entered into a contract for re-sheeting two of the gasholders, at a cost of upwards of £1000. They recommend that the price of gas be reduced by 5d. per 1000 cubic feet, making it 3s. 1½d. The profit on the year's trading was £2468.

In Hawick, a situation has arisen which I do not remember to have seen before. The public lighting of the town has hitherto been in the hands of the Gas Company. Now there is an Electric Supply Company in the place, and the two Companies are competing for the public lighting. Formal offers have been sent in to the Corporation, who have remitted them to a Committee. The Gas Company offer to do the work

* The worthy Town Councillors of Dundee will do well to compare the figures obtained by the "Special" correspondent with those given by Mr. E. Drory, Chief Engineer at Berlin of the Imperial Continental Gas Association, in his article on "Retort-House Working in Berlin," which appeared in the "JOURNAL" on the 25th of February last.—ED. J.G.L.

"EDUCATION

in the advantages
of Gas in reducing
the Coal

BILL"

is what every Gas
Manager wants to
give his Consumers.

On this subject, the

"EUREKA"

is an education in
itself.

for £700, and the Electricity Company for £1050. This is for the whole of the town. There are alternative offers, one of which contains the obnoxious principle so often adopted in public lighting, of giving the best thoroughfares to electricity and relegating gas to the side streets. Of course, the electricians claim that their light would be much the superior one; but the statement is somewhat out of date. The self-intensifying lamps offered by the Gas Company, it may be assumed, would give a better light than the sparsely placed arc lamps.

The Motherwell Gas Company have reduced the price of gas from 3s. 4d. to 2s. 11d. per 1000 cubic feet. This week eighty-nine £1 shares of the Company were sold by auction at the price of £143 10s. 3d., which is equal to £1 12s. 3d. per share.

The annual meeting of the Carluke Gas Company was held on Monday. It was reported that during the year the quantity of gas sold amounted to 11,930,000 cubic feet, an increase of 583,500 cubic feet over the previous year. The profit was £1028. A dividend at the rate of 10 per cent. was paid, and £528 was carried forward. The price of gas was reduced from 3s. 9d. to 3s. 4d. per 1000 cubic feet.

The latest record as to gas-rents received by the Treasurer to the Glasgow Corporation Gas Trust comes down to the 28th of May, which is practically the close of the year 1901-2. It amounted to £582,439 17s. 3d., while the collection made by the Treasurer at the corresponding date of last year was £555,398 15s. 6d.; thus showing an increase for the year amounting to £27,041 1s. 9d. Against this increase for gas consumed must be put a decrease in the revenue derived from the sale of residual products amounting to £13,598 10s. 2d.; the amount for the year 1900-1901 being £188,737 10s., and that for the year ending the 28th of May last to £175,138 19s. 10d.

The Newport (Fife) Town Council this week entered into contracts for the erection of new gas-works, at a total cost of £7191. The steel roofing, purifiers, condenser, and scrubber are to be furnished by Messrs. Henry Balfour and Co., Limited, of Leven; the retort-settings, chimney, and exhauster, by Messrs. R. & J. Dempster, Limited, of Manchester; the station meter by Messrs. J. Milne and Son, Limited, of Edinburgh; and the governor by Messrs. D. Bruce Peebles and Co., of Edinburgh.

Sudbury (Suffolk) Electric Light Scheme.—The Electric Lighting Committee of the Sudbury Town Council have received from the Local Government Board a letter on the subject of the Council's application for a loan of £12,000 for electric lighting purposes. The matter, it may be remembered, was inquired into by Mr. Law, one of the Board's Inspectors, on the 14th of May. They regard the scheme of the Town Council as generally satisfactory; but they state that, as the margin of borrowing powers available is insufficient, they are unable to sanction the loan. The Town Clerk has been instructed to write to the Council's Electrical Engineer, enclosing a copy of the letter, and asking his advice as to the best mode of procedure under the circumstances.

CURRENT SALES OF GAS PRODUCTS.

Our Liverpool market correspondents write: Sulphate of Ammonia—The market throughout the past week has been totally of a holiday character; and prices are mainly nominal. We do not, therefore, see any advantage in sending a report this week.

Tar Products. LONDON, *June* 28.

The market is very quiet, and there is little or no business doing. Pitch is very firm indeed, especially for delivery in London, where very high prices have been paid for home consumption. These high values, however, must not be taken as a criterion of the prices ruling for shipment, as, owing to the warm weather, there is nothing more to be done for export until next season. Business is reported by some of the makers in the North, over the whole of next year, at fairly good prices; and the South Wales consumers are now inquiring for delivery over July-December next. In benzol, there is nothing fresh to report, buyers being totally indifferent as to the article. It is reported that there has lately been a better inquiry for pure, but no actual business appears to have been arranged. Crude carbolic continues weak. Consumers will not now pay more than 1s. 9½d. for 60's, July-September, while for July-December they decline to offer at present. Crystals are still quiet. There are several sellers of 39-40's at 5¾d. per lb., prompt delivery. Creosote continues dull. There is rather more offering in the Midlands where stocks are large. As regards toluol, solvent naphtha, and anthracene, the position is unchanged; there being no demand for either prompt or forward delivery.

Average values during the week were: Tar, 17s. to 22s. Pitch, London, 47s. 6d. to 48s. 6d.; east coast, 45s. to 45s. 6d.; west coast, 39s. 6d. to 40s. Benzol, 90 per cent., 8d.; 50-90 per cent., 7d. Toluol, 8½d. Crude naphtha, 2¾d.; solvent naphtha, 9d. to 9½d.; heavy naphtha, 9d. to 10d. Creosote, London, 1¼d.; North, 1d. Heavy oils, 1⅛d. Carbolic acid, 60 per cent., 1s. 10d. Naphthalene, 35s. to 50s. Salts, 21s. to 22s. 6d. Anthracene, "A," 1½d. to 1¾d.; "B," 1d. nominal.

Sulphate of Ammonia.

The market is decidedly easier, and closes weak; consumers having evidently supplied all their requirements for June. Business is reported at £12 5s. July delivery, Beckton terms; but for forward delivery there is very little inquiry. In Liverpool, the market is flat. During the early part of the week, business was reported at £12 10s. Leith makers maintain their price of £12 10s.; but buyers will not pay this, and £12 8s. 9d. may be taken as the closing quotation. As regards Hull, business was reported at £12 7s. 6d. in the early part of the week; but it is doubtful whether consumers would now pay this price. The market is decidedly quiet; and it is probable that lower prices will rule during the next two or three months.

THE
MAXIM PATENT CARBURETTOR
FOR ENRICHING GAS IN BULK.
PREVENTS NAPHTHALENE DEPOSITS.
OVER 100 MAXIM PATENT CARBURETTORS HAVE NOW BEEN FIXED.
Among the Companies and Towns supplied are The Gas Light and Coke Company, The South Metropolitan Gas Company, Birmingham, Leeds, Rochdale, Bristol, Sheffield, Southport, Alloa, Broughty Ferry, Dunfermline, and many other Works, both large and small, where they have been working in some instances for the past Seven Years.
MORE GAS & SALEABLE COKE PER TON of COAL CARBONIZED is PRODUCED; SAVING CAPITAL, LABOUR, FUEL, WEAR & TEAR, &c.
THE ENRICHMENT IS INSTANTANEOUS AND PERMANENT.
The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.
Dealers in Benzol, Carburine, and all other Naphthas and Oils suitable for the Enrichment or Production of Gas.
For Prices and full Particulars, apply to
THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,
18, DEVONSHIRE STREET, BISHOPSGATE, LONDON, E.C.

COAL TRADE REPORTS.

Lancashire Coal Trade.

Collieries generally throughout this district were closed on Wednesday evening, as previously arranged, in anticipation of the Coronation celebrations, and were not to resume full work again until yesterday (Monday). With mills and works also very generally closed over a similar period, and only one 'Change meeting in Manchester during the past week, there has necessarily been a general suspension of both business and industrial operations. Up to the holidays, there was a fairly active inquiry for most descriptions of fuel; and collieries were moving away all that pits were raising. Prices remain steady at recent quotations; and it is practically decided that there shall be no alteration in the list basis with the close of the month. At the pit, best Wigan Arley averages 13s. 6d. to 14s. per ton, Pemberton four-feet and seconds Arley 12s. to 12s. 6d., and common house coal 9s. 6d. to 10s. The lower qualities of round coal have been moving off moderately well on account of inland requirements; but the shipping demand has been indifferent. Prices are about maintained; and there is comparatively very little giving way even on contracts for forward delivery—3d. to 6d. per ton on current rates representing about the utmost limit of the concession that coalowners are prepared to make on contracts. At the pit, 8s. 6d. to 9s. per ton represents about average figures for steam and forge coals; and for steam coal prices range from 9s. 9d. to 10s. 3d. per ton according to quality, delivered at Mersey ports. Gas coal contracts are being gradually concluded; but there is a good deal of business yet to be settled. This year, users of gas-making fuel seem to be buying more largely than ever the lower qualities, such as slack and nuts, which are evidently found suitable for present requirements in connection with the enriching processes by means of oils and water gas. For good Arley slack, suitable for gas-making purposes, 7s. 9d. to 8s. per ton is being obtained, with gas nuts ranging upwards, according to quality, from about 8s. 3d. per ton. Common screened gas coals remain about 8s. 9d. to 9s. per ton, and best screened Arley gas coals are quoted at 10s. to 10s. 3d. For slack there is an increasing inquiry. There is still a good deal of competition with Lancashire slack in outside districts; but in that county prices are tending to harden slightly—4s. 9d. to 5s. 6d. per ton being minimum prices for common, up to 6s. 6d. and 7s. for the better qualities, and about 8s. for washed slacks.

Northern Coal Trade.

There has been the twofold interruption in the coal trade of the partial national holidays and of the chief local holidays on Tyneside; and this has influenced alike production and consumption of fuel. Best Northumbrian steam coals are steady at 11s. 3d. to 11s. 6d. per ton f.o.b.; but most other classes are plentiful, and dull in price. Second-class steam coals are from 9s. 3d. to 10s. per ton, and steam smalls vary from 4s. 9d. to 5s. Household coals are very weak, the finer weather having limited the consumption. In the gas coal trade, the demand has been very limited, through the bright, warm weather. The price has been from 8s. 3d. to 9s. 3d. per ton f.o.b., according to the quality. One or two contracts are being arranged, but they are not for large quantities, and are unlikely to show much variation from prices recently settled. Gas coke has been rather more freely shipped, and the production is now very small; so that stocks are being reduced. The price quoted is still about 10s. per ton f.o.b.

Scotch Coal Trade.

Trade is somewhat steadier, probably owing to the imminence of holidays, combined with the export season being at its height. Nearly all the large annual coal contracts have been entered into, almost the only one remaining being that of the Glasgow Corporation Gas Department. When this is settled, the market will be more open, as the fixtures, both in price and quality, will be known. The prices quoted are: Main, 8s. 3d. to 8s. 6d. per ton f.o.b. Glasgow, ell 9s. 3d. to 10s. 3d., and splint 9s. 3d. to 9s. 6d. The shipments for the week amounted to 233,279 tons—an increase of 12,853 tons upon the previous week, and of 9663 tons upon the corresponding week of last year. For the year to date, the total shipments have been 4,709,389 tons—an increase of 418,128 tons upon the same period of last year.

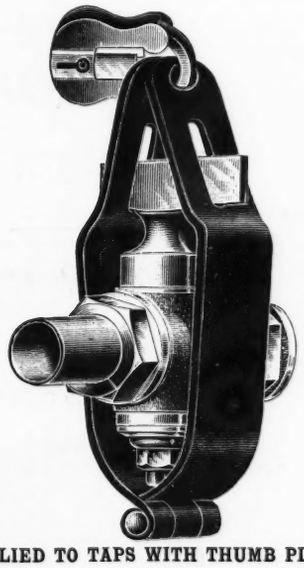
Explosion in a Hull Street.—An accident of a singular character occurred in Hull at midnight last Saturday. Two young men were walking along one of the principal thoroughfares when one of them lit a cigarette and threw down the match. There was immediately a serious explosion, and he was blown to the other side of the road, sustaining severe injuries to the head. The explosion is attributed to an escape of gas through a manhole, over which the men were passing.

Price of Gas for Public Lighting at Swansea.—At their meeting last Tuesday, the Streets Committee of the Swansea Corporation had before them a letter from Mr. Thornton Andrews, the Secretary of the Swansea Gas Company, giving notice of the Company's intention to terminate the public lighting agreement as from the 29th of September next. He was, however, instructed by the Directors to add that they were prepared to enter into a new contract as from that date, and would require it to contain provisions to the following effect: "(1) The price to be charged to the Corporation for gas supplied to the public lamps to be the same as that charged for the time being to private customers in the district in which such lamps may be situate. (2) The supply of gas to each lamp for 91 hours hitherto given by the Company free of charge to be paid for thereafter." It was decided to ask the Electrical Engineer to report on the practicability of illuminating the present gas standards with incandescent electric lamps; and it was also resolved to get a report from the Town Clerk as to the legal position of the Corporation, with the view of establishing municipal gas-works if desirable.

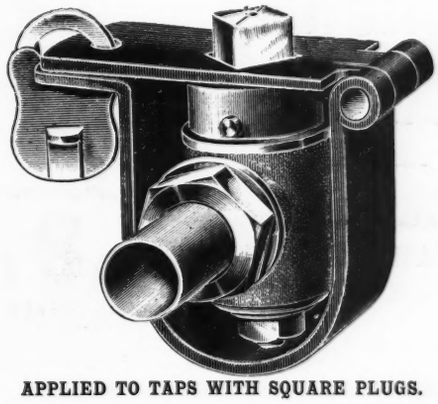
NEWBIGGING'S PATENT

MAIN TAP FASTENERS

"THE MOST SECURE METHOD OF LOCKING TAPS."



APPLIED TO TAPS WITH THUMB PLUGS.



APPLIED TO TAPS WITH SQUARE PLUGS.

Prices and Particulars on application to—

SAWER & PURVES,

NELSON METER WORKS, MANCHESTER.

Huddersfield Gas Supply.—The Borough Treasurer of Huddersfield (Mr. S. C. Potts) has presented a statement of the coal and oil employed in the manufacture of gas for the year ended the 31st of March, from which it appeared that of the former the quantity used was 65,598 tons 8 cwt. 2 qrs., compared with 61,054 tons 15 cwt., and of the latter 147 tons 19 cwt., compared with 253 tons 7 cwt. 2 qrs. The gas supplied for lighting was 286,971,200 cubic feet; for stoves and power, 143,984,900 cubic feet; for prepayment meters, 79,314,600 cubic feet; for public and private lamps, 56,628,100 cubic feet; for special supply to balloons, 80,000 cubic feet; for and by contract for the Market Hall, 638,200 cubic feet—giving a total of 567,617,000 cubic feet, compared with 560,473,800 cubic feet last year. There were fixed 128 prepayment meters, and 56 cooking and heating stoves.

Proposed Wayleave for Gas-Mains at Barnard Castle.—At the last meeting of the Barnard Castle Urban District Council, the following motion was submitted by Mr. Emerson: "That the Gas Company be charged an annual sum for wayleave of gas-mains at the rate of so much per mile, the charge to be submitted to the Council by the Lighting Committee." He remarked that for many years the Company had been paying a dividend at the rate of 10 per cent. per annum, and had from time to time carried forward enormous sums to capital account. At present they were engaged in enlarging their works on a very extensive scale, and the undertaking was being carried through without creating additional share capital. From the day the works were established, not a farthing had been paid to the custodians of the highways in the shape of wayleave, although the privilege of laying the mains without any charge constituted the most important asset in the Company's finances. Mr. J. A. York, in seconding the motion, remarked that the Company was in a flourishing condition, and well able to pay the reasonable demand. The motion was carried unanimously.

Death in a Gas-Heated Bath.—An inquest was held at the County Working Men's Club, Milnsbridge, last Tuesday, on the body of Allen Whiteley, aged 36, a woollen weaver, who died the previous Sunday from poisoning by gas inhaled while in a gas-heated bath at the Club the day before. It appeared that the deceased was the first to use the bath since the new apparatus had been put in; and the work was incomplete, no flue having been fixed. When he was found in the bath, there was practically no water in it. There was no smell of gas, which had been automatically turned off. The deceased's stepbrother, who had put in the heating apparatus, said he had told the Secretary of the Club that the bath should not be used until the flue was put in. The Secretary admitted this; but he said he thought the caretaker also knew of it, and would not allow any one to use the bath. The caretaker, however, denied that he knew anything about the matter. The Jury found that the deceased died from inhaling unconsumed gas from a water-heater that had not been properly fixed. At their request, the Coroner told the Secretary he ought to have informed the caretaker that the bath must not be used till a flue had been put in.

The Works Committee of the London County Council reported last Tuesday that the final estimate for the work at the Newington gas-meter testing office was £8278, and the actual cost £8611—an excess cost over the final estimate of £333, or about 4 per cent. It was stated that the excess had been caused by delay in the supply and fixing of the testing machinery.

By the liberality of the Directors of the Waterford Gas Company, the employees and friends, to the number of 160, had their annual picnic at Curraghmore, the seat of the Marquis of Waterford, last Thursday. The arrangements were carried out by the Company's Manager (Mr. J. G. Tooms), with the assistance of the chief officials; and they resulted in the production of a day's thorough enjoyment. The agent to the Marquis (Captain Gethin) afforded the party every opportunity of appreciating the delightful scenery surrounding the historic home of the Beresfords.

Since the collapse of the British Tube Association almost a year ago, competition and underselling in the trade have greatly increased; and the urgency of protective measures was emphasized when the recent advance of the minimum basis of gas strip to £7 a ton was declared. Accordingly, a representative meeting of the trade was held last week at Carlisle, when it was decided to reconstitute the British Tube Association, and that prices in the meantime should be fixed on the basis of 72½ per cent. discount off the list of gas, steam, and water tubes. A further meeting will be held to appoint a President; and it is expected that the headquarters will be fixedin Birmingham.

At the ordinary general meeting of the Lamp Manufacturing Company, Limited, yesterday, the Directors reported that the trading for the fourteen months ending the 30th of April had resulted in a loss of £901, which, with the heavy provision it had been necessary to make for bad debts, absorbed the amount standing to the credit of the profit and loss account, and left a debit balance of £728. The Directors pointed out that the circumstances attending this period had been adverse, and in many points exceptional; and they expressed regret that they were unable to recommend the payment of any dividend for the past year. The Company's new patent distant signal lamp promised, however, to be a very valuable property.

The Stettiner Chamotte Fabrik Actien Gesellschaft (vormals Didier), of Stettin, received some time since from the Hamburg Municipality an order for the erection of 24 retort-benches, containing nine inclined retorts each, for the gas-works at Barmbeck, Hamburg. The same Company have now on hand an order for the erection of the retort-benches for the new gas-works at Bellwarder, Hamburg. The plant consists of 24 benches, containing nine inclined retorts, each 5 metres (16 feet) in length. The plant for the breaking, elevating, and charging of the coal will also be erected by the Stettin Company. The benches are to be constructed according to the "Imperial" system, which is already at work at the Imperial Continental Gas Association's gas-works at Mariendorf, Berlin, described by Mr. Drory in an article in the "JOURNAL" for the 3rd ult. (p. 1483).

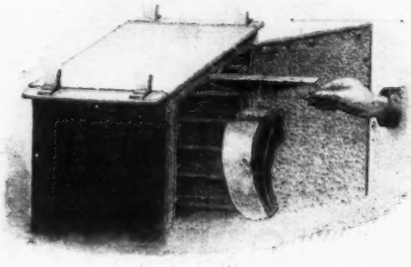
PARKINSON'S "CROWN" COOKERS.

DURABILITY OF ALL WORKING PARTS CAREFULLY STUDIED.

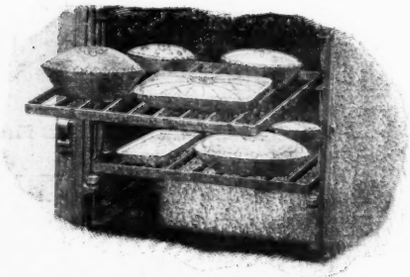
EMBODY SEVERAL IMPORTANT IMPROVEMENTS.

(See illustrations below.)

Patent Sliding Meat Hook.



Patent Self-Locking Grid Shelf.



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AND
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SPECIMEN "CONSUMPTION DEVELOPER" ADS.

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Smoked Out!

It's a nice experience in your own house, isn't it? Dirty coal, damp wood, poor draught in the coal range. It's awful, but you stand it, and pay twice as much for the alleged heat you get as you would for a clean, comfortable, convenient, non-smoking, always-ready-to-use-in-a-second "Richmond" gas-stove.

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GAS COMPANY'S OFFICES,
4, THE WALK.

No. 29.

The Comfort of It.

No carting coal. No waiting for it to burn up. No smoke. No dirt. No inconvenience. No time lost. Everything cooked on time, cooked well, cooked cleanly, cooked cheaper than on a coal fire.
We are speaking of a "Richmond" gas-stove.

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HIRE A
"RICHMOND" COOKER
TO-DAY.

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No. 41.

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Blamed for late breakfast because the fire wouldn't "draw"—the kettle wouldn't boil!! Husband gets in a temper and scolds—but why doesn't he hire a "Richmond" gas-stove to cook with, and so obviate such quarrels? That is the quickest, cleanest, handiest, and most comfortable way to cook. And it saves temper and—money!

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ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

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ACCOUNTANT. No. 3883.
DRIVER and FITTER at Water-Works. G. C.
ENGINEER and MANAGER of Small Gas-Works. No. 3881.

SITUATIONS VACANT.

BOILER FIREMEN. Coventry Gas-Works.
CLERK. No. 3884.
DRAUGHTSMAN. Willey and Co.
ENGINEER and MANAGER. Dundee Gas Department (July 22).
GAS-STOVE REPRESENTATIVE. – Willey and Co.
MANAGER. Cowes Gas-Works.
RETORT SETTER. Rotherham Gas-Works.
SECRETARY AND MANAGER. Denbigh Gas and Water Companies (July 18).

PLANT (Second-Hand) FOR SALE.

CONDENSER (250,000 cubic feet). Redditch Gas-Works.
GASHOLDERS (various). Wright, J., London.
PURIFIERS, SCRUBBER-WASHERS, GASHOLDERS, &c. Firth Blakeley, Dewsbury.
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SALES OF STOCKS AND SHARES.

BRISTOL WATER COMPANY. July 10.
EAST SURREY WATER COMPANY. Tenders by July 22.
ELLAND-CUM-GREETLAND GAS COMPANY. Tenders by July 17.
RICHARDS, Mr. ALFRED—July 8: Dorking Gas Company, Harwich Gas Company, North Middlesex Gas Company, Southend Water Company. July 22: Pinner Gas Company.
WOKING WATER AND GAS COMPANY. Tenders by July 5.

TENDERS FOR

COAL.

BATLEY. 18,000 tons. Tenders by July 14.
COALVILLE. 1750 tons. Tenders by July 10.
COPENHAGEN. 60,000 to 70,000 tons. Tenders by July 7.
DEWSBURY. 22,000 tons. Tenders by July 9.
ILKESTON. 9000 tons. Tenders by July 14.
KENDAL. 5600 tons. Tenders by July 12.
LIMERICK. 8000 or 17,000 tons. Tenders by July 29.
MIDDLETON. 10,000 tons. Tenders by July 9.
ROCHDALE. 30,000 to 55,000 tons. Tenders by July 16.
SHEFFIELD. One Year's Supply. Tenders by July 17.

GASHOLDER.

LEICESTER. Three-Lift. Tenders by July 14.

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SALFORD. Tenders by July 10.

LIME.

HEYWOOD. Tenders by July 15.

METERS.

DEWSBURY. Tenders by July 9.

PIPES.

DEWSBURY. Tenders by July 9.

SULPHURIC ACID.

DEWSBURY. Tenders by July 9.
HEYWOOD. Tenders by July 15.

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Magnesia and Alumina	0·5
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SATURATORS and LEAD WORK for Sulphate of Ammonia Plants.
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Twice as Rich as Bog Ore.
Gives no Back Pressure.
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Apply, stating Age and Experience, to WILLEY & Co., Gas Engineers, EXETER.

WANTED, a Good Draughtsman, who has had extended experience in all kinds of Gas Apparatus. Must be capable of Estimating Costs and making Working Drawings.
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Apply, stating Wages required, to the undersigned.
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Forms of application can be obtained from, and should be received by, the undersigned not later than Twelve noon on Monday, the 7th of July, 1902.
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Secretary to the Gas Committee.
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DENBIGH GAS AND WATER COMPANIES.

WANTED, a Secretary and Manager.
Must have a thorough knowledge of Gas Manufacture, the Distribution of Gas and Water, Secretarial Work, and Bookkeeping. Make of Gas: 12 Millions.
Salary £150 per annum.
Applications, with Particulars as to Age and Qualification, accompanied by *copies* of recent Testimonials, endorsed "Application Secretary and Manager," to be sent in by the 18th of July, addressed to the CHAIRMAN, Gas and Water Companies, DENBIGH.

GAS ENGINEER AND MANAGER FOR DUNDEE.

THE Dundee Gas Commissioners invite Applications for their Vacant Office of GAS ENGINEER and MANAGER.
For proposed Salary and other Particulars apply to the undersigned.
Applications to be lodged with the undersigned on or before the 22nd of July next.
THOS. THORNTON,
Town Clerk.
City Chambers, Dundee,
June 20, 1902.

COAL GAS TAR wanted.
State Quantity to offer for Prompt and Forward Delivery.
The SHARPNESS CHEMICAL COMPANY, Tar Distillers, Sharpness Docks, GLOS.

OXIDE OF IRON.

FIRE Cement, Paint, Mains, Tubes, STREET LANTERNS, GLASS, TOOLS, &c.
BALE & CHURCH,
5, CROOKED LANE, CANNON STREET,
LONDON, E.C.

PATENT BLOW LAMPS for Soldering Purposes, absolutely dispensing with Rushes. Made in three sizes. Much approved of by leading Engineers.
E. PADFIELD & Co, West India House, 96 and 98, LEADENHALL STREET, E.C.

TO GAS AND WATER OFFICIALS.

COURT ROYAL CYCLES enable the rider to experience all the true delight and irresistible charm of a grand health-yielding pastime. These Cycles are now supplied ON SPECIAL TERMS to Gas and Water Officials.
Apply for Catalogues, Books of Testimonials, and Particulars of EASY TERMS of purchase, to the Makers, LLOYD COURTS & Co., COVENTRY; or to our LONDON AGENTS, Messrs. E. PADFIELD & Co., West India House, 96 and 98, Leadenhall Street, LONDON.

WANTED, in an Accountant's Office a CLERK who can write Shorthand and Typewrite, and who has also had some experience in Bookkeeping.
Write, stating Age and Salary required, to No. 3884, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, four good second-hand PURIFIERS, 8 ft. or 9 ft. square, complete with Lifting Apparatus, Valves, and Connections.
LIVESEY WASHER, second-hand. Capacity about 100,000 cubic feet per diem, with Valves and Connections.
ROTARY EXHAUSTER, with combined Steam-Engine, direct-driven type, second-hand. Capacity 20,000 to 25,000 cubic feet per hour, complete with Governor, Valves, and Connections.
Particulars and Prices to ISAAC CARR, M.Inst.C.E., Consulting Engineer, Farnworth, WIDNES.

TEST HOLDERS.

TWO Good 10 feet or 12 feet Test HOLDERS wanted complete.
Address No. 3882, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SPECIAL OFFER of Gas Purifiers.
Six Perfect 20 feet Square PURIFIERS, planed Joints, Lutes 2 feet deep, made to Newbigging's Specification. Bargain to early Purchasers.
FIRTH BLAKELEY, DEWSBURY.

GASHOLDER and Cast Tank, 200,000 cubic feet capacity. Nearly new. Erected complete and guaranteed perfect for Half Price. Exceptional Chance and Bargain.
FIRTH BLAKELEY & Co., Thornhill, DEWSBURY.

CONDENSER for Sale—Morris and CUTLER'S "PERFECT;" capacity 250,000 cubic feet per 24 hours. In perfect condition. New in 1888, and recently retubed.
Apply to A. E. LAYTON, Manager, Gas-Works, REDDITCH.

TO BE SOLD—
10-inch SCRUBBER-WASHER, by Clapham, overhauled and perfect.
12-inch SCRUBBER-WASHER, by Holmes overhauled and perfect.
FIRTH BLAKELEY, DEWSBURY.

FOR SALE—Station-Meter, to pass 20,000 cubic feet per hour, by J. & J. Braddock, with 12-inch Valves and Bye-pass. Can be seen at work by appointment.
Apply to Mr. WILLIAM PARLBY, Gas-Works, HEREFORD.

GAS PLANT for Sale of all kinds.
GASHOLDERS, 15 ft. to 50 ft. diameter.
Iron or Steel TANKS for ditto.
SCRUBBERS AND WASHERS, by Holmes, Clapham, &c.
CONDENSERS—Pipe, Annular, and Patent Condensers.
PURIFIERS, from 4 ft. to 20 ft. square.
RETORT-FITTINGS, METERS, GOVERNORS VALVES, &c.
Every Description of NEW PLANT supplied.
FIRTH BLAKELEY AND Co., Gas Engineers, DEWSBURY.

TO BE SOLD—
GASHOLDER, 14 ft. by 10 ft. with 3 Columns and Suspension.
GASHOLDER, 16 ft. by 10 ft. with 4 Columns.
GASHOLDER, 20 ft. by 10 ft. with 4 Columns and Suspension.
GASHOLDER, 30 ft. by 12 ft. with 4 Columns.
GASHOLDER, 43 ft. by 14 ft. with 5 Columns and Suspension.
GASHOLDER, 45 ft. by 14 ft. with 5 Columns and Two Lift.
GASHOLDER, 80 ft. by 20 ft. with 10 Columns Two Lift.
Write J. WRIGHT, 181, Queen Victoria Street, E.C.